INTELLIGENT MODEL FOR OPTIMAL CONTROL OF TARGET WINDOWS AT END POINT IN OXYGEN STEELMAKING

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Dedicated to

Goddess SARASWATI, the source of all knowledge

25.2.01

CERTIFICATE

It is certified that the work contained in this thesis entitled **INTELLIGENT MODEL FOR OPTIMAL CONTROL OF TARGET WINDOWS AT END POINT IN OXYGEN STEELMAKING** has been carried out by Mr. Divyesh Dixit under my supervision and that this work has not been submitted elsewhere for the award of a degree.

Brahma Deo 27/02/2001

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HeatNo	Heat Number
Date	Date of production
ChargeNo	Charge Number
WBATH	Weight of bath, Kg
GRY	Weight of hot metal, Kg
GSCHROT	Weight of scrap, Kg
C0	Wt % carbon in hot metal
Mn0	Wt % manganese in hot metal
P0	Wt % phosphorus in hot metal
Si0	Wt % silicon in hot metal
LNSLF	Lance life
LIM1	Lime added during first part of blow, Kg
DOLO1	Dolomite added during first part of blow, Kg
ORE1	Ore added during first part of blow, Kg
RSL1	Return slag added before blowing, Kg
RDOLO1	Raw dolomite added during first part of blow, Kg
T1	Temperature at sublance measurement, ^{0}K
C1	Wt% carbon in metal at sublance measurement
Mn1	Wt% manganese in metal at sublance measurement
P1	Wt% phosphorus in metal at sublance measurement
O21	Oxygen blown during first part of blow, m^3
O22	Oxygen blow during second part of blow, m^3
LIM2	Lime added during second part of blow, Kg
DOLO2	Dolomite added during second part of blow, Kg
ORE2	Ore added during second part of blow, Kg
RSL2	Return slag added before second part of blow, Kg
RDOLO2	Raw dolomite added during second part of blow, Kg
HL2	Lance height during second part of blow, cm

T2	Metal temperature at the end of blow, ^0K
C2	Wt % carbon in metal at the end of blow
Mn2	Wt % manganese in metal at the end of blow
P2	Wt % phosphorus in metal at the end of blow
Oact2	Dissolved oxygen in metal at the end of blow, ppm
σ	Standard error of prediction
r	Correlation coefficient

ABSTRACT

Introduction of sublance technology in the early eighties to analyze carbon and temperature in an Oxygen steelmaking converter during the blow, approximately 3-4 minutes before the end of blow, proved to be an important step in the control of oxygen steel making processes.

Once we have sublance temperature and carbon, the next step is to develop some models, which will predict end point temperature and composition, given all the process parameters and variables. In the present work, based on industrial data, linear models are developed for the prediction of endpoint temperature, carbon, manganese, phosphorus and dissolved oxygen in metal. The variables were passed through a stepwise selection scheme to find sensible variables. From these linear models, we observed that Lance height, Oxygen blown, dolomite added, ore added, raw dolomite added, return slag added, lime added (all during second blow) are all important process variables which affect the end point temperature and composition of the metal.

The next problem is to decide these process variables in advance, keeping in view the target end point temperature and composition. It is not possible to exactly match the target so a window around the target is constructed with lower and upper bound on each of the values. Our objective is that the heat should lie inside the window and as close as possible to the target value. The cost incurred due to deviation from target is minimized. We considered two components of cost, the cost due to deviation from target and the cost due to violation of window. The cost due to latter is much severe. We used micro genetic algorithm to minimize the cost and decide the process variables. It was found that in more than 95% heats we could reach within a narrow range of target end point temperature and composition.

Chapter 1
Introduction

Oxygen steel making process, now known by several names such as BOP, BOF, LD etc. is one of the most dynamic processes of steel making in which oxidation of dissolved elements like carbon, silicon, phosphorous and manganese take place simultaneously while the dissolved oxygen content and temperature of the bath increase towards the end of blow. The BOF process, due to its high productivity and excellent quality, has become most popular process for steel making. It however suffers from the drawback that it is difficult to get a simultaneous hit of target carbon content, molten steel temperature, phosphorus content, manganese content and dissolved oxygen of the bath at the turndown.

Depending on the grade of steel, these variables are subjected to some quality constraints. Satisfying all the constraints simultaneously is not possible all the time. Therefore, we have to choose an optimum combination of the operating parameters so that the cost (or penalty) incurred is minimum. Genetic Algorithms (GA's) are natural choice in such complex multivariable optimization problems. Chapter 2 gives an introduction to genetic algorithms and micro GA and formulation of the optimization problem. For faster convergence micro GA is considered suitable.

The aim of this thesis is to develop prediction and optimization models for industrial end point control in 300 ton BOF. Several models are reported in literature for predicting end point variables, but in an earlier work [1], it was shown that in small range of operating variables, linear models do fairly well in predictions. In Appendix 1, a brief review of literature regarding models for predicting end point carbon is given. In chapter 4, development of linear models for the industrial data is discussed.

Results and discussions are described in chapters 4 and 5. Chapter 4 gives the results on linear models and their prediction while chapter 5 gives the results of intelligent optimization model and discusses them.

Chapter 2
Intelligent optimization and control models

2.1 Introduction

Artificial intelligence techniques, such as genetic algorithms (GA) and neural nets have been used for both optimization and control purposes in steelmaking[2-6]. In the present work GA is used in combination with end point prediction equation for optimal control of BOF operation. A brief introduction to GA's, including an advanced algorithm called Micro-GA is given first followed by the technique of window formulation for end point temperature, carbon, manganese, phosphorus and dissolved oxygen. In the last part of the chapter the objective function for minimization is defined.

2.2 Genetic algorithms and micro-GA

Genetic algorithms are search algorithms based on mechanics of natural selection and natural genetics. Considerable literature on GA's is now available[7]. GA's combine survival of the fittest among string structures with a structured yet randomized information exchange to form a search algorithm with some of the innovative flair of human search. In every generation a new set of artificial creatures (strings) is created using bits and pieces of fittest of the old; an occasional new part is tried for good measure. While randomized, genetic algorithms are no simple random walk. They efficiently exploit historical information to speculate on new search points with expected improved performance. Genetic algorithms are now finding more widespread application in business, scientific and engineering circles. Genetic algorithms are very powerful and robust in solving complex and multimodal problems.

Genetic algorithm is a population-based algorithm, i.e. it works with a set of points in the search space. We first encode points into finite length binary string then we recursively apply some operators until we are able to find the optimum. These operators

generally are selection, crossover and mutation, although there are some other operators found in GA literature. In GA's we work with some initial number of strings and this remains constant in most of GA's. This number is called the **population size**.

The aim of selection process is to favor fitter individuals. The fitness of a string can be suitably defined in a maximization or minimization problem. There are several selection schemes available, which include Roulette wheel selection and tournament selection. In Roulette wheel selection the probability of selection of a string is directly proportional to its fitness. After selection the selected strings are crossed over.

The aim of crossover is to synthesize a possibly better string from two good strings. There are many types of crossover, which include Single point crossover and Uniform crossover. Uniform cross over is used in a special kind of genetic algorithm called micro GA. In single point cross over a random crossover site is generated and two parts of the crossing strings are swapped. These new string generated are called children while original strings are called parents. There is some probability that parent will not be replaced by children. The probability of replacement of parents by children is called **crossover probability**.

$$\begin{array}{l} 10001\ 010001 \\ 11010\ 101111 \end{array} \xrightarrow{\text{Cross Over}} \begin{array}{l} 10001\ 101111 \\ 11010\ 010001 \end{array}$$

In uniform crossover, bit-by-bit examination of strings is done and the corresponding bits are exchanged with some probability. The crossover probability here represents the probability of exchange of bits. A crossover probability of 0.5 represents very severe crossover in this case.

There is one operator, which is usually used to fine tune the optimum obtained. This is called mutation. In simplest kind of mutation called jump mutation we examine a single string bit by bit and change it with a certain small probability called **mutation probability**.

GA's are very computation intensive. The population size is large in case of normal GA's. Thus, sometimes GA's become slow in giving results. This can be very dangerous in critical application where time is very important. A new fast GA was developed by Krishnakumar[1], called micro GA. Micro GA uses a small population of 5 to 10 strings.

It uses uniform crossover and elitist selection scheme. In elitist selection scheme the maximum fitness string is always chosen. Micro GA is very successful in the case of non-stationary function, i.e. those functions that change with time and continuous optimization is needed. In case of process control of steel making we want to have fast results so we decided to use micro GA.

The GA driver was downloaded from the UIUC website. The program is written in Fortran. A description of the program is provided in Appendix 2. It was interfaced with programs using shell script and c programs to the data. We have created a package, which can be used to optimize a single heat also. The package is user friendly. The script of a session using the package is given in the Appendix 3.

2.3 Window formulation for end point control

A window defines the permitted upper and lower bounds for a given target or aim value. Lower and upper bounds are necessary because of stochastic nature as well as inherent variability of the BOF process. The objective is therefore to minimize the cost due to possible deviation from the aimed values for all parameters i.e., for temperature, carbon, phosphorus, manganese and dissolved oxygen at end point in a BOF. Depending upon the nature of variable, the cost arising due to deviations out of windows may be very high. These costs are also added to the original cost function. Thus our objective is to minimize total cost where

Total costs = Costs due to deviation from aim values + Costs due to deviation outside window

2.3.1 Carbon Window

Carbon window is formulated by allowing some predefined deviation from aim value. Care is taken that window's limit does not go beyond certain predefined minimum and maximum values. The minimum and maximum values are set because our regression equations were developed for a certain range of carbon only. The carbon window is given by

$$\Phi_c \le \xi_c \le \Psi_c$$

where ξ_c is predicted carbon, Φ_c and Ψ_c are the lower and upper limits of window, respectively.

here
$$\Phi_c = \begin{cases} c_{aim} - \sigma_{lc} & \text{if } \Phi_c \ge 0.030 \\ 0.030 & \text{if } \Phi_c < 0.030 \end{cases}$$

and
$$\Psi_c = \begin{cases} c_{aim} + \sigma_{uc} & \text{if } \Psi_c \ge 0.066 \\ 0.066 & \text{if } \Psi_c < 0.066 \end{cases}$$

where σ_{lc} and σ_{uc} are lower and upper limits of deviation allowed. In this case σ_{lc} and σ_{uc} are one and the same and they are set equal to the σ_c, which is the standard error for prediction of carbon.

2.3.2 Temperature window

Similar to carbon window, the temperature window is formulated as

$$\Phi_T \le \xi_T \le \Psi_T$$

where, ξ_T is predicted temperature, Φ_T and Ψ_T are the lower and upper limits of window. Here, $\Phi_T = T_{aim} - \sigma_{lt}$ and $\Psi_T = T_{aim} + \sigma_{ut}$. σ_{lT} and σ_{uT} are the allowed upper and lower deviations allowed.

In our work, we have chosen $\sigma_{lT} = 5^0C$ and $\sigma_{uT} = 15^0C$ because higher temperature can be easily brought down by adding coolants (or by allowing the converter to idle) but when temperature is lower than target, reblowing may be needed else there will be problems at the casting station. This problem is however less acute when ladle furnace is available for temperature and composition adjustments at a later stage.

2.3.3 Phosphorus window

No lower limit is specified for phosphorus in this work. It is assumed a priori that any lower value than aimed is an advantage in terms of minimizing the adverse effects of phosphorus on ultimate steel quality. Phosphorus window is given by,

$$\xi_P \le P_{aim}$$

where ξ_P is predicted phosphorus and P_{aim} is aim phosphorus.

2.3.4 Manganese window

Manganese window is formulated similar to phosphorus window and is given by,

$$\xi_{Mn} \le (Mn_{aim} + 0.03)$$

where ξ_{Mn} is predicted manganese and Mn_{aim} is aim manganese. We allowed some deviation above aim value because manganese is not as harmful as phosphorus.

2.3.5 Dissolved oxygen window

Dissolved oxygen window is given by

$$\Phi_{[O]} \leq \xi_{[O]} \leq \Psi_{[O]}$$

where $\xi_{[O]}$ is predicted dissolved oxygen, $\Phi_{[O]}$ and $\Psi_{[O]}$ are the lower and upper limits of window respectively, Here $\Phi_{[O]} = [O]_{aim} - \sigma_{[O]}$ and $\Psi_{[O]} = [O]_{aim} + \sigma_{[O]}$, where $\sigma_{[O]}$ is the allowed deviation for dissolved oxygen window. We have used $\sigma_{[O]}$ as 162 ppm.

2.4 Objective function for optimization

There are two components of costs. The first component is due to deviation from aim values and the second component is due to violation of window limits. These costs are defined below.

-Costs for deviation for aim values

Temperature: 1 cost point for each degree Kelvin deviation from aim value. For example if our aim temperature is 1672 K and predicted temperature is 1666K cost will be (1672-1666) = 6 points.

Carbon, phosphorus, manganese, dissolved oxygen: 1 cost point for each one percent deviation from aim value. For example if aim carbon=0.040 and predicted carbon=0.042 then Cost= (0.042-0.040)*100/0.040 = 0.002*100/0.040 = 5 points.

-Costs for violation of windows:

Inside the window cost is zero. Outside the window the cost is decided on the basis of distance from the window boundary. These costs are 10 times higher than the inside costs as defined earlier. Thus, Carbon component of cost can be written as

$$F_c = \frac{\|\xi_c - C_{aim}\| * 100}{C_{aim}} + \frac{\langle \Phi_c - \xi_c \rangle * 1000}{C_{aim}} + \frac{\langle \xi_c - \Psi_c \rangle * 1000}{C_{aim}}$$

where $\|x\|$ represents the absolute value of x and $< >$ is bracket operator function.

$$< x >= \begin{cases} 0 & \text{if } x < 0 \\ x & \text{if } x \geq 0 \end{cases}$$

Similar equations can be written for other components of cost. These are:

-for temperature

$$F_T = \|\xi_T - T_{aim}\| + \langle \Phi_T - \xi_T \rangle * 10 + \langle \xi_T - \Psi_T \rangle * 10$$

-for phosphorus

$$F_P = \frac{\|\xi_P - P_{aim}\| * 100}{P_{aim}} + \frac{\langle \xi_P - P_{aim} \rangle * 1000}{P_{aim}}$$

-for manganese

$$F_{Mn} = \frac{\|\xi_{Mn} - Mn_{aim}\| * 100}{Mn_{aim}} + \frac{\langle \xi_{Mn} - Mn_{aim} - 0.03 \rangle * 1000}{Mn_{aim}}$$

-and for oxygen

$$F_{[O]} = \frac{\left\| \xi_{[O]} - [O]_{aim} \right\| * 100}{[O]_{aim}} + \frac{\left\langle \Phi_{[O]} - \xi_{[O]} \right\rangle * 1000}{[O]_{aim}} + \frac{\left\langle \xi_{[O]} - \Psi_{[O]} \right\rangle * 1000}{[O]_{aim}}$$

The total cost (F_{total}) is obtained by adding all these costs and the objective of genetic algorithm is to minimize the total cost F_{total}.

$$F_{total} = F_C + F_T + F_P + F_{Mn} + F_{[O]}$$

Chapter 3

The Plant Data

The industrial data was acquired for a 300-ton converter. For this converter there are altogether 4 datasets comprising of 297, 200, 100 and 100 heats, respectively. These datasets are named as D1, D2, D3 and D4, respectively and are listed in the Appendix 4. The first dataset D1 contains all the information about the variables listed in the Table 3.0. This data set was used to develop the basic linear regression equations. The next data set D2 (containing 200 heats) was named as target dataset as it contained the targeted values of end point variables, carbon, temperature, manganese, dissolved oxygen and phosphorus. The next two datasets D3 and D4 (of 100 heats each) contained information about all the variables without any target values.

According to operational restrictions, ore ORE2 and raw dolomite RDOLO2 cannot be added together in the second part of blow. Due to this constraint we partitioned the datasets further into three parts. First group consists of heats in which the variables both Ore2 and Rdolo2 are zero. In second group of heats, Rdolo2 is nonzero while Ore2 is zero. In third group of heats, Ore2 is nonzero while Rdolo2 is zero. We partitioned the original dataset D1 of 297 heats into these three groups. As a result first group contained 110 heats, second contained 111 heats, and the third contained 60 heats. The remaining 16 heats were rejected as they violated the operational restrictions.

The plant data consisted several variables, which are explained in Table 3.1. Table 3.2-3.3 give the statistics of the data for the dataset D1, D2, D3 and D4, separately. Besides these original variables, certain variables, which are considered to be fundamental in the steel making process, were also tried in linear regression models. These variables are as follows:

(i) Hot Ratio (HTR): Hot ratio is defined as the ratio of weight of hotmetal to the weight of scrap. This affects both the temperature and composition of bath. For example; consider heat number 1739 of dataset D1

Hot metal weight=271900 Kg

Scrap weight=52000 Kg

$$\text{Thus, hot ratio HTR} = \frac{271900}{52000}$$

$$= 5.229$$

(ii) Basicity (BAS): Slag consists of CaO, SiO_2 and other oxides. While CaO is basic in nature, SiO_2 is acidic in nature. The nature of slag has a profound effect on the refining process in steelmaking. In our calculations we have defined basicity as:

$$\text{BAS} = \frac{\text{LIM1} + \text{DOLO1}}{\text{WSiO}_2}$$

where $$\text{WSiO}_2 = \text{GRY} * \frac{\text{Si0}}{100} * \frac{60}{28}$$

For example; consider heat number 1739 of dataset D1

LIM1=lime added during first blow;11231 Kg; GRY=Weight of hot metal =271900 Kg; Si0=hot metal silicon=0.556 %;

$$WSiO_2 = 271900 * \frac{0.556}{100} * \frac{60}{28} = 3239.5 \text{ Kg}$$

$$\text{Basicity } BAS = \frac{11231}{3239.5} = 3.4669$$

(iii) Slag Volume (SVOL): During the blow, oxygen is blown with supersonic jets at very high speed, so the metal droplets are thrown into the slag. These droplets travel through slag and react with it. Thus the amount of slag has a significant effect on the refining process. We assumed that slag volume is proportional to the slag mass, thus we used slag mass in regression models. Slag volume is defined as:

$$SVOL = WSiO_2 + LIM1 + RSL1$$

For example; consider heat number 1739 of dataset D1

$WSiO_2$=3239.5 Kg; LIM1=11231 Kg; RSL1=3346 Kg

Slag volume SVOL=3239.5+11231+3346=17816.5

Table 3.1 Variables defined in plant data

Variable	**Full Name**	**Unit**
HeatNo	Heat Number	----------
Date	Date of production	---------
ChargeNo	Charge Number	---------
WBATH	Weight of bath	Kg
GRY	Weight of hot metal	Kg
GSCHROT	Weight of scrap	Kg
C0	Wt % carbon in hot metal	Wt%
Mn0	Wt % manganese in hot metal	Wt%
P0	Wt % phosphorus in hot metal	Wt%
Si0	Wt % silicon in hot metal	Wt%
LNSLF	Lance life	Number of heats
LIM1	Lime added during first part of blow	Kg
DOLO1	Dolomite added during first part of blow	Kg
ORE1	Ore added during first part of blow	Kg
RSL1	Return slag added before blowing	Kg
RDOLO1	Raw dolomite added during first part of blow	Kg
T1	Temperature at sublance measurement	^{0}K
C1	Wt% carbon in metal at sublance measurement	Wt%
Mn1	Wt% manganese in metal at sublance measurement	Wt%
P1	Wt% phosphorus in metal at sublance measurement	Wt%
O21	Oxygen blown during first part of blow	Nm^3
O22	Oxygen blow during second part of blow	Nm^3
LIM2	Lime added during second part of blow	Kg
DOLO2	Dolomite added during second part of blow	Kg
ORE2	Ore added during second part of blow	Kg
RSL2	Return slag added before second part of blow	Kg
RDOLO2	Raw dolomite added during second part of blow	Kg
HL2	Lance height during second part of blow	Cm
T2	Metal temperature at the end of blow	^{0}K
C2	Wt % carbon in metal at the end of blow	Wt%
Mn2	Wt % manganese in metal at the end of blow	Wt%
P2	Wt % phosphorus in metal at the end of blow	Wt%
Oact2	Dissolved oxygen in metal at the end of blow	ppm

Table 3.2 Summary of datasets D1 and D2

Variable	D1			D2		
	Range	Mean	σ	Range	Mean	σ
Heat No.	1739-2545	--------	-------	2251-3331	-------	--------
Date	01SEP00-23SEP00	--------	-------	23SEP00-10OCT00	-------	--------
Charge No.	--------	--------	-------	-------	-------	--------
WBATH	262900-352700	320208	11652	292400-336800	319491	8864
GRY	250000-311600	289803	11656	250200-308200	288901	10596
GSCH-ROT	35300-73400	53843	8204	34600-73400	54287	7395
C0	4.2640-4.9900	4.6688	0.1047	4.2860-4.8650	4.6695	0.0917
Mn0	0.2970-0.4740	0.3886	0.0381	0.2990-0.4260	0.3739	0.0221
P0	0.0530-0.0660	0.0579	0.0023	0.0520-0.0640	0.0574	0.0021
Si0	0.2760-0.9670	0.4933	0.1258	0.1360-0.8160	0.4158	0.1079
LNSLF	1-225	69.78	50.34	0-201	95.180	56.2759
LIM1	8512-20041	14527	2814	8545-20035	13998	2628
DOLO1	0-0	0	0	0-0	0	0
ORE1	0-11947	4447	2516	0-8567	3433	2205
RSL1	0-6921	3654	911	2-7003	3630	950
RDOLO1	0-4523	630	723	0-2001	674	566.6
T1	1516-1665	1602.64	22.97	15225-1666	1606	24.07
C1	0.1120-0.7870	0.3367	0.1117	0.111-0.727	0.3409	0.1213
Mn1	0.1240-0.3990	0.2931	0.0428	0.156-0.387	0.2980	0.034
P1	0.0040-0.0510	0.0248	0.0083	0.006-0.059	0.0295	0.0089
O21	10398-14982	12971.6	800.7	10527-14104	12864	683
O22	1146-3582	1996.6	359.0	1243-3330	1993	370.8
LIM2	0-503	19.24	94.78	0-502	14.91	84.78
DOLO2	0-2003	86.17	394.11	0-0	0	0
ORE2	0-1401	181.31	336.70	0-15225	273.21	352.65
RSL2	0-2527	114.84	429.36	0-3258	130.89	480.15
RDOLO2	0-3969	376.84	642.24	0-2276	305	461.62
HL2	143-249	208.43	19.21	136-230	185	26.14
T2	1599-1708	1667.31	18.68	1618-1713	1668	18.08
C2	0.030-0.0840	0.0486	0.0083	0.03-0.087	0.0473	0.0088
Mn2	0.063-0.270	0.1563	0.0343	0.075-0.245	0.1620	0.0313
P2	0.004-0.028	0.0107	0.0034	0.004-0.023	0.0120	0.0038
Oact2	266-1371	735.53	239.68	288-1178	652.32	180.42

Table 3.3 Summary of datasets D3 and D4

Variable	D3			D4		
	Range	Mean	σ	Range	Mean	σ
Heat No.	3337-3685	------	-----	3687-3971	------	------
Date	10OCT00-19OCT00	------	-----	19OCT00-24OCT00	------	------
Charge No.	--------	------	------	---------	------	-------
WBATH	289500-331700	315965	8507	290100-336100	319766	6773.9
GRY	250000-307600	287929	11656	250100-297800	282915	9617.5
GSCH-ROT	35800-68300	54475	8254	46700-7800	62187	8158.0
C0	4.3340-4.891	4.6829	0.1107	4.574-4.856	4.7128	0.0593
Mn0	0.323-0.422	0.3753	0.0216	0.33-0.399	0.3696	0.0144
P0	0.015-0.083	0.0609	0.0040	0.051-0.064	0.058	0.0029
Si0	0.2460-0.815	0.4443	0.1038	0.315-0.66	0.4758	0.0645
LNSLF	0-242	166.42	58.80	0-225	49	47.11
LIM1	7166-20791	12770	2523	7202-16805	9324	1894.7
DOLO1	0-5994	683	1638	0-7938	3828	1680.9
ORE1	0-9159	3605	2479	200-8594	4487	1608.5
RSL1	0-4748	2916	1316	0-3481	874	707.58
RDOLO1	0-2008	483	531.8	0-3663	149	616.03
T1	1538-1679	1610	28.19	1536-1665	1613	24.31
C1	0.127-0.824	0.3813	0.1208	0.161-0.723	0.3916	0.1132
Mn1	0.184-0.378	0.2853	0.0398	0.148-0.329	0.2319	0.0473
P1	0.01-0.53	0.0262	0.0088	0.006-0.04	0.0214	0.0076
O21	10554-15400	12984	762.17	11102-14101	13102	464.28
O22	1348-3193	2068	359.84	1508-3496	2085	346.81
LIM2	0-2038	50.57	243.62	0-507	25.1	109.36
DOLO2	0-1992	20	198.2	0-0	0	0
ORE2	0-1049	249.7	363.46	0-4022	270.3	517.5
RSL2	0-3605	217	625.38	0-5014	523.28	1097.7
RDOLO2	0-2532	342	590	0-1261	185	336.04
HL2	169-246	215	15.69	138-249	196	15.51
T2	1624-1723	1670	19.4	1622-1714	1668	15.71
C2	0.032-0.105	0.0558	0.0141	0.03-0.109	0.0588	0.0142
Mn2	0.085-0.261	0.1565	0.0303	0.083-0.211	0.1421	0.0281
P2	0.005-0.031	0.0113	0.0039	0.004-0.018	0.0094	0.0026
Oact2	242-1522	590.64	265.71	240-940	453.92	112.21

Chapter 4
Linear prediction models

4.1 Development of prediction models for end point

Linear prediction models for end point prediction were developed using Nag routines. These Nag routines are available as standard nag libraries, which can be called in Fortran programs. The routine G02EEF was used to select the significant variables from the list of all possible independent variables, which may affect the dependent variable. The routine G02BAF was used to generate the moments from the data. These moments are used by routine G02CGF to finally give the linear models.

Besides these linear models, exponential model of carbon, in which a linear prediction equation for capacity mass transfer is used, is also developed.

4.2Results of multiple linear regressions

The results of linear regression runs are summarized in Tables 4.1-4.15. Exponential regression models for carbon, in which a linear prediction equation for capacity mass transfer coefficient is used, are summarized in Tables 4.16-4.18. The dataset D1 consisting of 297 heats, which was partitioned into three groups, was used in these regression runs. The table 4.0 gives a summary of these regression runs.

4.2.1 Sample calculations

Sample calculations for the linear prediction models described in Tables 4.1-4.15, for a single heat are given below.

-Table 4.1: In Heat No. R1751, C1=0.239, O22=1802, SVOL=21978

Calculated C2=0.239*0.0421385+1802*-0.000013575+21978*0.000000442+0.050873

=0.04619 (Actual 0.040)

-Table 4.2: In Heat No. R1739, C1=0.441, O22=2240, HL2=217, SVOL=17816

Calculated C2 = 0.05006*0.441-0.0000219*2240+0.000114*217+0.000000689*17816+ 0.038

= 0.0480 (Actual 0.043)

-Table 4.3: In Heat No. R1752, C1=0.348, O22=1995, LIM2=0, ORE2=460, HL2=238

Calculated C2 = 0.060*0.348-0.00002847*1995+0.000008546*460+0.0001774*238 +0.04166

= 0.0519 (Actual 0.050)

-Table 4.4: In Heat No. R1751, T1=1611, O22=1802, LIM2=0, HL2=213, HTR=6.672

Calculated T2 = 0.9608*1611+0.0438*1802-0.0117*0+0.0751*213+1.107*6.672+25.05

= 1675.20 (Actual 1685)

-Table 4.5: In Heat No. R1739, T1=1561, O22=2240, LIM2=0, DOLO2=0, RSL2=0,RDOLO2=1516, HL2=217

Calculated T2 = 0.8868*1561+0.03564*2240-0.00807*1516-0.0885*217+197.62

= 1630.31 (Actual 1625)

-Table 4.6: In Heat No. R1752, T1=1620, O22=1995, ORE2=460, RSL2=0, HL2=238,HTR=6.39

Calculated T2 = 0.9033*1620+0.0434*1995-0.0156*460-0.171*238+2.16*6.39+169.405

= 1685.26 (Actual 1690)

-Table 4.7: In Heat No. R1751, Mn0=0.372, T1=1611, C1=0.239, O22=1802, HL2=213, C2=0.04619(predicted), SVOL=21978, HTR=6.672, BAS=4.678

Calculated Mn2 = 0.3005*0.372+0.00074*1611+0.172*0.239-0.0000368*1802 +0.00013*213+1.287*0.04619-0.00000246*21978-0.00365*6.672 +0.0039*4.678-1.163176

$= 0.143$ (Actual 0.149)

-Table 4.8: In Heat No. R1739, Mn0=0.352, T1=1561, C1=0.441, O22=2240, DOLO2=0, RDOLO2=1516, T2=1630.31(Calculated), C2=0.048(Calculated), SVOL=17816, BAS=3.4669

Calculate Mn2 = 0.3155*0.352+0.00133*1561+0.1899*0.441-0.0000306*2240-
0.000019*1516-0.00029*1630.31+1.06*0.048-0.0000038*17816-
0.00298*3.469-1.5542
= 0.119 (Actual 0.105)

-Table 4.9: In Heat No. R1752, Mn0=0.381, T1=1620, C1=0.348, O22=1995, LIM2=0, DOLO2=0, ORE2=460, RSL2=0, T2=1685(Calculated), C2=0.0519(Calculated), SVOL=25717, BAS=4.34

Calculated Mn2 = 0.2877*0.381+0.00113*1620+0.1926*0.348-0.0000253*1995-
0.0000275*460-0.000195*1685+1.134*0.0519-0.0000023*25717-
0.0032*4.34-1.4234
= 0.178 (Actual 0.184)

-Table 4.10: In Heat No. R1751 P0=0.0579, DOLO2=0, HL2=213, T2=1675(predicted), C2=0.04619(predicted), Mn2=0.143(predicted), SVOL=21978, HTR=6.671940

Calculated P2 = 0.263*0.0579+0-0.0000288*213+0.000043*1675-0.069*0.04619
+0.069*0.143-0.000000229*21978+0.00028*6.67194-0.075205
= 0.00943 (Actual 0.0100)

-Table 4.11: For example, in Heat No. R1739, P0=0.059, HL2=217, T2=1630.31 (Calculated), C2=0.048(Calculated), Mn2=0.119(Calculated), SVOL=17816

Calculated P2 = 0.3158*0.059-0.0000325*217+0.0000957*1630.31+0.0939*0.048+
0.0507*0.119-0.000000445*17816-0.162815
= 0.00739 (Actual 0.007)

Table 4.0 Summary of regression results on the dataset D1 of appendix 1

Reference table	Linear Model description	Special constraints	Data set Location	Accuracy of prediction
Table 4.1	End point carbon control	Ore2=0 Rdolo2=0	D1 Appendix 1	σ=0.0053 r=0.6540
Table 4.2	End point carbon control	Ore2=0 Rdolo2≠0	D1 Appendix 1	σ=0.0069 r=0.6138
Table 4.3	End point carbon control	Ore2≠0 Rdolo2=0	D1 Appendix 1	σ=0.0064 r=0.6963
Table 4.4	End point temperature control	Ore2=0 Rdolo2=0	D1 Appendix 1	σ=6.4039 r=0.9059
Table 4.5	End point temperature control	Ore2=0 Rdolo2≠0	D1 Appendix 1	σ=8.4678 r=0.9031
Table 4.6	End point temperature control	Ore2≠0 Rdolo2=0	D1 Appendix 1	σ=7.9845 r= 0.9241
Table 4.7	Dissolved oxygen control	Ore2=0 Rdolo2=0	D1 Appendix 1	σ=189.1887 r=0.6778
Table 4.8	Dissolved oxygen control	Ore2=0 Rdolo2≠0	D1 Appendix 1	σ=142.1239 r=0.7720
Table 4.9	Dissolved oxygen control	Ore2≠0 Rdolo2=0	D1 Appendix 1	σ=134.7646 r=0.7715
Table 4.10	End point manganese control	Ore2=0 Rdolo2=0	D1 Appendix 1	σ=0.0132 r=0.9292
Table 4.11	End point manganese control	Ore2=0 Rdolo2≠0	D1 Appendix 1	σ=0.0130 r=0.9408
Table 4.12	End point manganese control	Ore2≠0 Rdolo2=0	D1 Appendix 1	σ=0.0143 r=0.8864
Table 4.13	End point phosphorus control	Ore2=0 Rdolo2=0	D1 Appendix 1	σ=0.0018 r=0.8182
Table 4.14	End point phosphorus control	Ore2=0 Rdolo2≠0	D1 Appendix 1	σ=0.0023 r=0.8308
Table 4.15	End point phosphorus control	Ore2≠0 Rdolo2=0	D1 Appendix 1	σ=0.0021 r=0.7155
Table 4.16	Carbon mass transfer coefficient near end point	Ore2=0 Rdolo2=0	D1 Appendix 1	-----------
Table 4.17	Carbon mass transfer coefficient near end point	Ore2=0 Rdolo2≠0	D1 Appendix 1	-----------
Table 4.18	Carbon mass transfer coefficient near end point	Ore2≠0 Rdolo2=0	D1 Appendix 1	-----------

Table 4.1 Summary of linear prediction model for C2 using dataset D1 (group1)*

Dendent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
C2 ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, SVOL,HTR,BAS	C1 O22 SVOL CONSTANT	0.042138504 -0.000013575 0.000000442 0.050873	σ=0.0053 r=0.6540

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.2 Summary of linear prediction model for C2 using dataset D1 (group2)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
C2 ORE2=0 RDOLO2$\neq$0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, SVOL,HTR,BAS	C1 O22 HL2 SVOL CONSTANT	0.050060497 -0.000021931 0.000114168 0.000000689 0.038007	σ=0.0069 r=0.6138

*Group 2 consists of heats for which RDOLO2$\neq$0 and ORE2=0

Table 4.3 Summary of linear prediction model for C2 using dataset D1 (group3)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
C2 ORE2$\neq$0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2, SVOL,HTR,BAS	C1 O22 LIM2 ORE2 HL2 CONSTANT	0.060102077 -0.000028469 -0.000023615 0.000008546 0.000177401 0.041659	σ=0.0064 r=0.6963

*Group 3 consists of heats for which RDOLO2=0 and ORE2$\neq$0

Table 4.4 Summary of linear prediction model for T2 using dataset D1 (group1)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
T2 ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, SVOL,HTR,BAS	T1 O22 LIM2 HL2 HTR CONSTANT	0.960814354 0.043802837 -0.011723530 0.075109580 1.107001549 25.050055	σ=6.4039 r=0.9059

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.5 Summary of linear prediction model for T2 using dataset D1 (group2)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
T2 ORE2=0 RDOLO2 $\neq$ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, SVOL,HTR,BAS	T1 O22 LIM2 DOLO2 RSL2 RDOLO2 HL2 CONSTANT	0.886800372 0.03564128 -0.021140074 -0.004277747 -0.008669891 -0.008073328 -0.088514272 197.619990	σ=8.4678 r=0.9031

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.6 Summary of linear prediction model for T2 using dataset D1 (group3)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
T2 ORE2 $\neq$ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2, SVOL,HTR,BAS	T1 O22 ORE2 RSL2 HL2 HTR CONSTANT	0.903288146 0.043384088 -0.015635069 -0.006714139 -0.17097950 2.161500311 169.405449	σ=7.9845 r= 0.9241

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

Table 4.7 Summary of linear prediction model for Mn2 using dataset D1 (group1)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
Mn2 ORE2=0 RDOLO2=0	Mn0,T1,C1,O22, LIM2,DOLO2, RSL2,HL2, T2,C2,SVOL,HTR, BAS	Mn0 T1 C1 O22 HL2 C2 SVOL HTR BAS CONSTANT	0.300525655 0.000741625 0.171760349 -0.000036792 0.000130775 1.287354594 -0.000002459 -0.003649055 0.003902635 -1.163176	σ=0.0132 r=0.9292

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.8 Summary of linear prediction model for Mn2 using dataset D1 (group2)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
Mn2 ORE2=0 RDOLO2 $\neq$ 0	Mn0,T1,C1,O22, LIM2,DOLO2, RSL2,RDOLO2, HL2,T2,C2,SVOL, HTR,BAS	Mn0 T1 C1 O22 DOLO2 RDOLO2 T2 C2 SVOL BAS CONSTANT	0.315546534 0.001328585 0.189916495 -0.000030600 -0.000004419 -0.000019065 -0.000291708 1.061411681 -0.000003804 -0.002979311 -1.554208	σ=0.0130 r=0.9408

*Group 2 consists of heats for which RDOLO2$\neq$0 and ORE2=0

Table 4.9 Summary of linear prediction model for Mn2 using dataset D1 (group3)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
Mn2 ORE2 ≠ 0 RDOLO2=0	Mn0,T1,C1,O22, LIM2,DOLO2, ORE2,RSL2, HL2,T2,C2,SVOL, HTR,BAS	Mn0	0.287657475	σ=0.0143 r=0.8864
		T1	0.001126155	
		C1	0.192631598	
		O22	-0.000025336	
		LIM2	-0.000046660	
		DOLO2	-0.000008290	
		ORE2	-0.000027500	
		RSL2	-0.000005548	
		T2	-0.000194654	
		C2	1.134257008	
		SVOL	-0.000002313	
		BAS	-0.003202942	
		CONSTANT	-1.423426	

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

Table 4.10 Summary of linear prediction model for P2 using dataset D1 (group1)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
P2 ORE2=0 RDOLO2=0	P0,T1,C1,O22, LIM2,DOLO2, RSL2,HL2,T2, C2,Mn2,SVOL, HTR,BAS	P0	0.262965456	σ=0.0018 r=0.8182
		DOLO2	0.000001515	
		HL2	-0.000028851	
		T2	0.000043017	
		C2	-0.060858325	
		Mn2	0.069068364	
		SVOL	-0.000000229	
		HTR	0.000281388	
		CONSTANT	-0.075205	

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.11 Summary of linear prediction model for P2 using dataset D1 (group2)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
P2 ORE2=0 RDOLO2 $\neq$ 0	P0,T1,C1,O22, LIM2,DOLO2, RSL2,RDOLO2, HL2,T2,C2,Mn2, SVOL,HTR,BAS	P0 HL2 T2 C2 Mn2 SVOL CONSTANT	0.315780703 -0.000032456 0.000095672 0.093936674 0.050712348 -0.000000445 -0.162815	σ=0.0023 r=0.8308

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.12 Summary of linear prediction model for P2 using dataset D1 (group3)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
P2 ORE2 $\neq$ 0 RDOLO2=0	P0,T1,C1,O22, LIM2,DOLO2, ORE2,RSL2, HL2,T2,C2,Mn2, SVOL,HTR,BAS	P0 ORE2 HL2 T2 Mn2 SVOL CONSTANT	0.234064707 -0.000002757 -0.000042313 0.000027988 0.047250703 -0.000000361 -0.038820	σ=0.0021 r=0.7155

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

Table 4.13 Summary of linear prediction model for Oact2 using dataset D1 (group1)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
Oact2 ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, T2,C2,SVOL,HTR, BAS	LIM2 DOLO2 HL2 C2 CONSTANT	0.362841895 0.109714957 -3.807404690 -19791.21856 2503.654180	σ=189.1887 r=0.6778

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.14 Summary of linear prediction model for Oact2 using dataset D1 (group2)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
Oact2 ORE2=0 RDOLO2 $\neq$ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, T2,C2,SVOL,HTR, BAS	T1 C1 LIM2 RSL2 RDOLO2 T2 C2 HTR CONSTANT	-11.51006726 -1181.147900 0.352647390 0.187922487 0.082205909 12.725908627 -3546.561199 -24.49704435 -1367.055692	σ=142.1239 r=0.7720

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.15 Summary of linear prediction model for Oact2 using dataset D1 (group3)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
Oact2 ORE2 $\neq$ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2,T2, C2,SVOL,HTR, BAS	LIM2 ORE2 HL2 C2 CONSTANT	-.381741035 -.127769642 -2.478146971 -17065.111683 2138.106569	σ=134.7646 r=0.7715

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

Table 4.16 Summary of exponential prediction model for C2 using dataset D1 (group1)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
k ORE2=0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,RSL2,HL2, SVOL,HTR,BAS	C1 O22 SVOL CONSTANT	0.014427903 -0.000003647 -0.000000067 0.015946	σ=0.0011 r=0.7812

Table 4.17 Summary of exponential prediction model for C2 using dataset D1 (group2)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
k ORE2=0 RDOLO2 $\neq$ 0	T1,C1,O22,LIM2, DOLO2,RSL2, RDOLO2,HL2, SVOL,HTR,BAS	T1 C1 O22 LIM2 HL2 SVOL HTR CONSTANT	-0.000008623 0.010516247 -0.000003611 -0.000000784 -0.000015054 -0.000000091 0.000167811 0.033548	σ=0.0010 r=0.7082

*Group 2 consists of heats for which RDOLO2$\neq$0 and ORE2=0

Table 4.18 Summary of exponential prediction model for C2 using dataset D1 (group3)*

Dependent Variable, Constraint	Independent Variables tried	Independent Variables Selected	Coefficients	Standard deviation and correlation coefficient
k ORE2 $\neq$ 0 RDOLO2=0	T1,C1,O22,LIM2, DOLO2,ORE2, RSL2,HL2, SVOL,HTR,BAS	C1 O22 ORE2 HL2 CONSTANT	0.013677933 -0.000002201 -0.000001552 -0.000026113 0.018160	σ=0.0014 r=0.6943

*Group 3 consists of heats for which RDOLO2=0 and ORE2$\neq$0

-Table 4.12: In Heat No. R1752, P0=0.060, ORE2=460, HL2=238, T2=1685(Calculated), Mn2=0.178(Calculated), SVOL=25717

Calculated P2 = 0.234*0.060-0.000002757*460-0.000042*238+0.000028*1685+
0.047*0.178-0.00000036*25717-0.03882
= 0.0102 (Actual 0.011)

-Table 4.13: In Heat No. R1751, LIM2=0, DOLO2=0, HL2=213, C2=0.04619(predicted)

Calculated Oact2 = 0.3628*0+0.1097*0-3.8074*213-19791*0.04619+2503.654
= 778.5 (Actual 886)

-Table 4.14: In Heat No. R1739, T1=1561, C1=0.441, LIM2=0, RSL2=0, RDOLO2=1516, T2=1630.31(Calculated), C2=0.048(Calculated), HTR=5.229

Calculated Oact2 = -11.51*1561-1181*0.441+0.0822*1516+12.726*1630.31-
3546*0.048-24.497*5.229-1367
= 718 (Actual 618)

-Table 4.15: In Heat No. R1752, LIM2=0, ORE2=460, HL2=238, C2=0.0519(Calculated)

Calculated Oact2 = -0.12777*460-2.478*238-17065*0.0519+2138.1
= 603.89 (Actual 579)

-Table 4.16: In Heat No. R1751, C1=0.239, O22=1802, SVOL=21978

Calculated mass transfer coefficient k = 0.0144279*0.239-0.000003647*1802-
0.0000000067*21978+0.015946
k = 0.01135

time t=1802*60/750=144.16 sec, since flow rate of oxygen is 750 m^3/min

final carbon C2= C1*exp(-kt)
= 0.239*exp(-0.01135*144.16)
= 0.0465 (Actual 0.040)

-Table 4.17: In Heat No. R1739, T1=1561, C1=0.441, O22=2240, LIM2=0, HL2=217, SVOL=17816, HTR=5.23

Calculated k = -0.000008623*1561+0.0105*0.441-0.0000036*2240-0.000015*217

-0.0000000091*17816+0.0001678*5.23+0.033548

= 0.012655

time t=2240*60.0/750.0=179.2 sec, since flow rate of oxygen is 750 m^3/min

final carbon C2 = C1*exp(-kt)

= 0.441*exp(-0.012655*179.2)

= 0.04566(Actual 0.430)

-Table 4.18: In Heat No. R1752, C1=0.348, O22=1995, ORE2=460, HL2=238

Calculated k = 0.01368*0.348-0.000002201*1995-0.000001552*460-0.000026113*238

+0.018160

= 0.0116

time t=1995*60.0/750.0=159.6 sec, since flow rate of oxygen is 750 m^3/min

final carbon C2 = C1*exp(-kt)

= 0.348*exp(-0.0116*159.6)

= 0.0546 (Actual 0.050)

4.3Results and discussion of end point prediction

The linear prediction models, which are described in section 4.2, are used to predict the end point, given all the parameters of the blow.

4.3.1End point carbon prediction

When we plot error in carbon prediction versus actual carbon for the dataset D3, which is shown in Fig 4.1, we find that errors become higher, as the actual carbon wt% increases. We observed that errors become unacceptable above 0.060% actual carbon. This can be ascribed due to nonlinear nature of the process. In the dataset D1, almost all the heats were below 0.060% carbon, thus the linear equations developed are valid in that range

only. If we want to predict carbon in higher range, we should develop separate models with the help of adequate data. Thus we conclude that our predictions are valid in the range below 0.060% final carbon.

The actual versus predicted carbon graphs are given in Figs 4.2-4.5 for the four datasets. Table 4.19 gives the average and RMS deviations of predicted carbon from actual carbon for the heats below 0.060% final carbon.

It is observed from Table 4.19 we observe that as we proceed from D1 to D4, the error in prediction keeps on increasing. We can thus say that as we go along heats, the changes in converter and lance conditions are such that the effective equation for predicting carbon keeps on changing and a stationary linear model can not give good results over long time.

4.3.1.1 Comparison of linear and exponential model for end point carbon prediction

It was found in earlier work [1] that linear prediction models for carbon perform better than non-linear prediction models in a small range of operating variables. We also tried an exponential model for carbon in which a linear prediction equation for capacity mass transfer coefficient of carbon is developed. The summary of these exponential models for different group of heats of dataset D1 is given in Tables 4.16-4.18. The predicted carbon using exponential models versus actual carbon for the dataset D1 is shown in Fig 4.6. The predicted carbon using linear models versus actual carbon for the dataset D1 is shown in Fig 4.2. We see much less scattering in the Fig 4.2 than in Fig 4.6. Also, RMS error in prediction for exponential models on dataset D1 is 0.0063 wt%, while RMS error in prediction for linear models on dataset D1 is 0.0054%. Thus we see that even for the dataset used in present work the linear prediction models give better results than exponential models in this carbon range (where carbon is less than 0.060 wt%).

4.3.2 End point temperature prediction

Figure 4.7 shows actual versus predicted end point carbon for dataset D1. Table 4.20 lists the deviations of predicted temperature from actual temperature for the datasets D1, D2, D3 and D4. It is evident from Fig 4.7 that predictions of temperature for the dataset D1 are satisfactory. Also we see from Table 4.20 that the error in prediction in temperature keeps on increasing as we go from D1 to D4.When. Figures 4.8-4.10 show error in temperature prediction versus serial number of heat for datasets D1, D2 and D3, respectively. From these figures we observe that as the serial number increases, the actual temperature becomes lower and lower than the predicted temperature. This phenomenon can be attributed to refractory erosion. This can be corrected if we apply time series analysis to correct the periodic errors. Another solution is to incorporate the most recent heats only in the linear regression. We have tried the latter in the next section on sequential linear regression models.

4.3.3 End point manganese prediction

Plots of predicted versus actual manganese are shown in Figs 4.11-4.14. Table 4.21 lists the deviations of predicted manganese from actual manganese for the four datasets. It is evident from the Table 4.21 that error in prediction increases as we go from dataset D1 to dataset D4. This again confirms the conclusion that conditions of converter keep on changing with time and it is not possible to get good prediction using a single set of linear prediction equation for all heats. In Figs 4.13-4.14, for most of the heats predicted manganese is higher than the actual value. Thus, it can be said that changes in converter profile shifts the predictions in a particular direction and not randomly.

4.3.4 End point phosphorus prediction

Plots of predicted versus actual phosphorus are shown in Figs 4.15-4.18. Table 4.22 lists the deviations of predicted manganese from actual manganese for the four datasets. The same trend as observed in the case of carbon, temperature and manganese, is also observed with phosphorus. The error in prediction of phosphorus increases as we move

from D1 to D4. For dataset D3, most of heats have higher predicted phosphorus than actual phosphorus and in dataset D4, all the heats have higher predicted phosphorus than actual phosphorus. Thus, in phosphorus prediction also we see a gradual shift in error of prediction in one direction.

4.3.5 End point dissolved oxygen prediction

Plots of predicted versus actual dissolved oxygen are shown in Figs 4.19-4.22. Table 4.23 lists the deviations of predicted manganese from actual manganese for the four datasets. We see quite a lot of scatter even in prediction for the dataset D1. Also the error in prediction increases to unacceptable limits as we move from dataset D1 to dataset D4. In dataset D4, for all the heats the predicted dissolved oxygen is much higher than the actual value.

Thus, we see that in end point predictions, there is a gradual shift in error of prediction in one direction as we proceed from dataset D1 to dataset D4 (increasing campaign life). This gradual shift can be attributed to the changing converter and lance conditions. We can thus conclude that a single linear prediction model cannot give good predictions for a large number of heats and changing converter and lance conditions must be incorporated in the model as we proceed in time.

4.4 Sequential linear regression models

As we have seen in the previous section that converter conditions keep on changing continuously and the linear equation should be modified with these changing conditions for good end point predictions. An effective way is to keep on adding the data of new heats and deleting the data of oldest heats from the data file by which we develop regression equations. We did updating of the data file in the batches of 60. In doing these linear regressions, we did not consider LIME2, DOLO2 and RSL2 as variables, as these

Table 4.19 Deviation of predicted carbon (wt%) from actual carbon using linear prediction equations from Tables 4.1-4.3

Data set	D1	D2	D3	D4
Average deviation	0.004344	0.004839	0.005173	0.008606
RMS deviation	0.005393	0.006266	0.006341	0.010620

Table 4.20 Deviation of predicted temperature (^{0}K) from actual temperature using linear prediction equations from Tables 4.4-4.6

Data set	D1	D2	D3	D4
Average deviation	5.68	7.53	7.08	11.64
RMS deviation	7.28	9.51	9.38	14.25

Table 4.21Deviation of predicted manganese (wt%) from actual manganese using linear prediction equations from Tables 4.7-4.9

Data set	D1	D2	D3	D4
Average deviation	0.01172	0.0151	0.0182	0.0404
RMS deviation	0.01438	0.0196	0.0260	0.0492

Table 4.22 Deviation of predicted phosphorus (wt%) from actual phosphorus using linear prediction equations from Tables 4.10-4.12

Data set	D1	D2	D3	D4
Average deviation	0.00157	0.00218	0.00349	0.00583
RMS deviation	0.001987	0.00280	0.00452	0.00646

Table 4.23 Deviation of predicted dissolved oxygen (ppm) from actual dissolved oxygen using linear prediction equations from Tables 4.13-4.15

Data set	D1	D2	D3	D4
Average deviation	154.37	238.25	201.83	368.56
RMS deviation	186.83	301.57	241.41	382.62

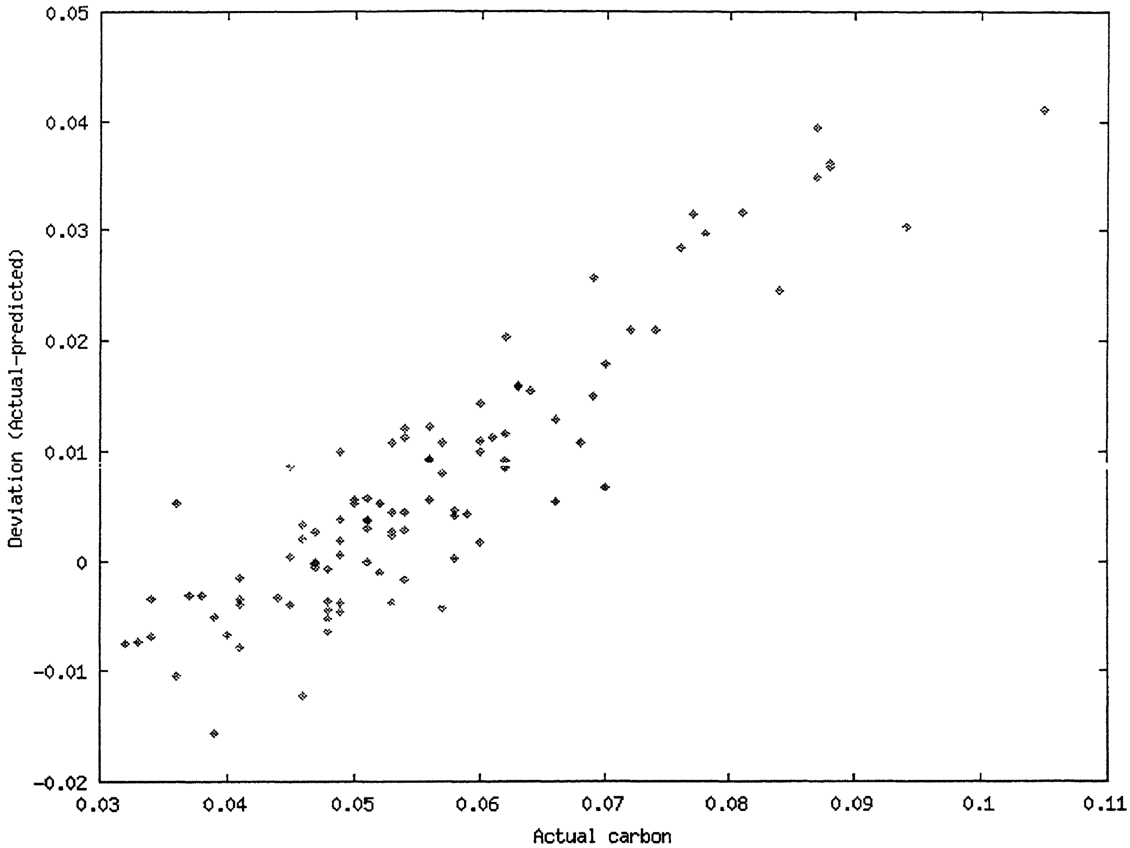

Fig 4.1 Deviation (actual-predicted) in carbon wt% versus actual carbon wt% for dataset D3 using linear prediction equations from Tables 4.1-4.3

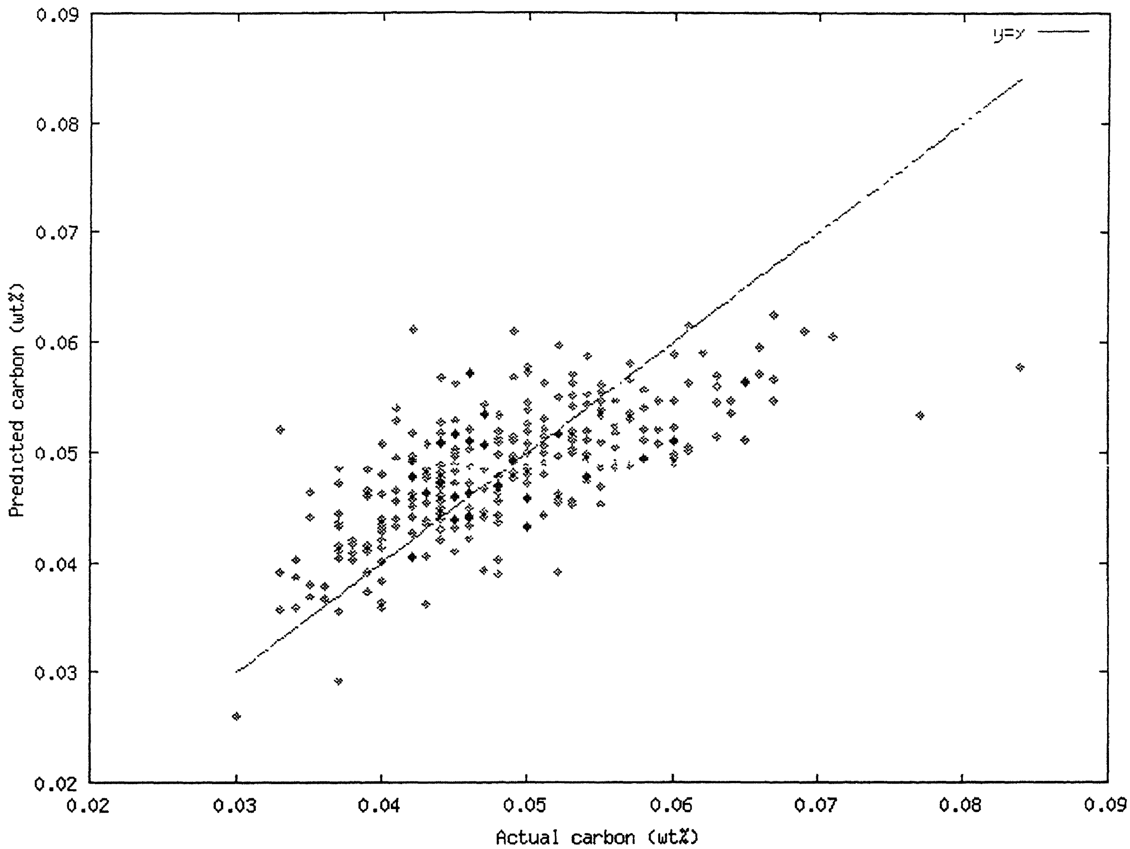

Fig 4.2 Predicted carbon versus actual carbon in wt% for dataset D1 using linear prediction equations from Tables 4.1-4.3

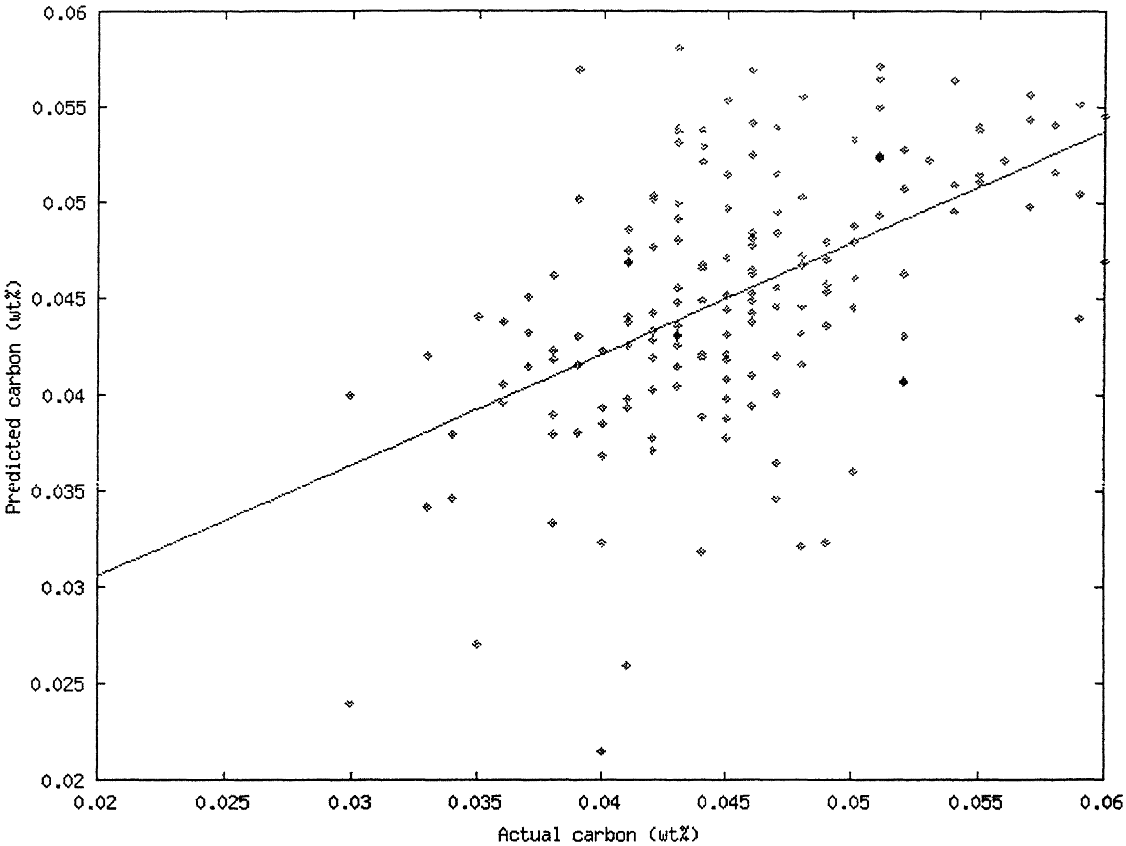

Fig 4.3 Predicted carbon versus actual carbon in wt% for dataset D2 using linear prediction equations from Tables 4.1-4.3

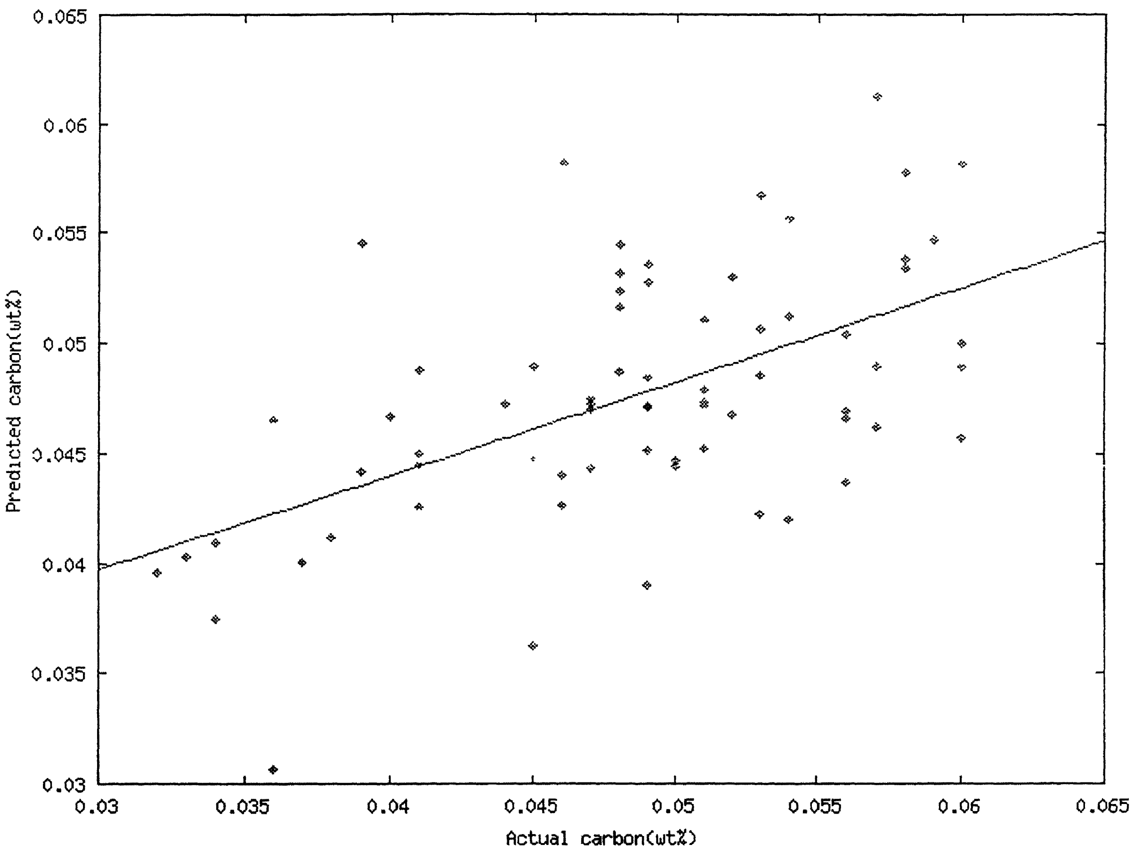

Fig 4.4 Predicted carbon versus actual carbon in wt% for dataset D3 using linear prediction equations from Tables 4.1-4.3

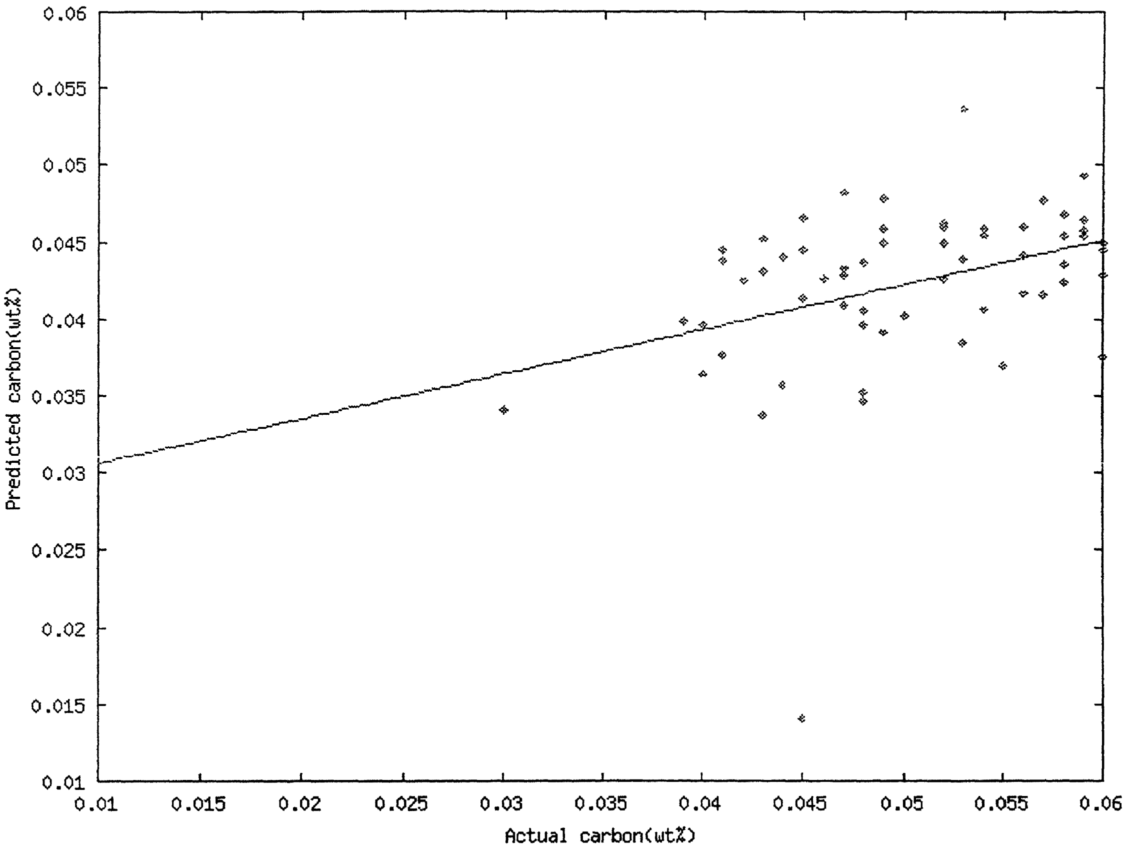

Fig 4.5 Predicted carbon versus actual carbon in wt% for dataset D4 using linear prediction equations from Tables 4.1-4.3

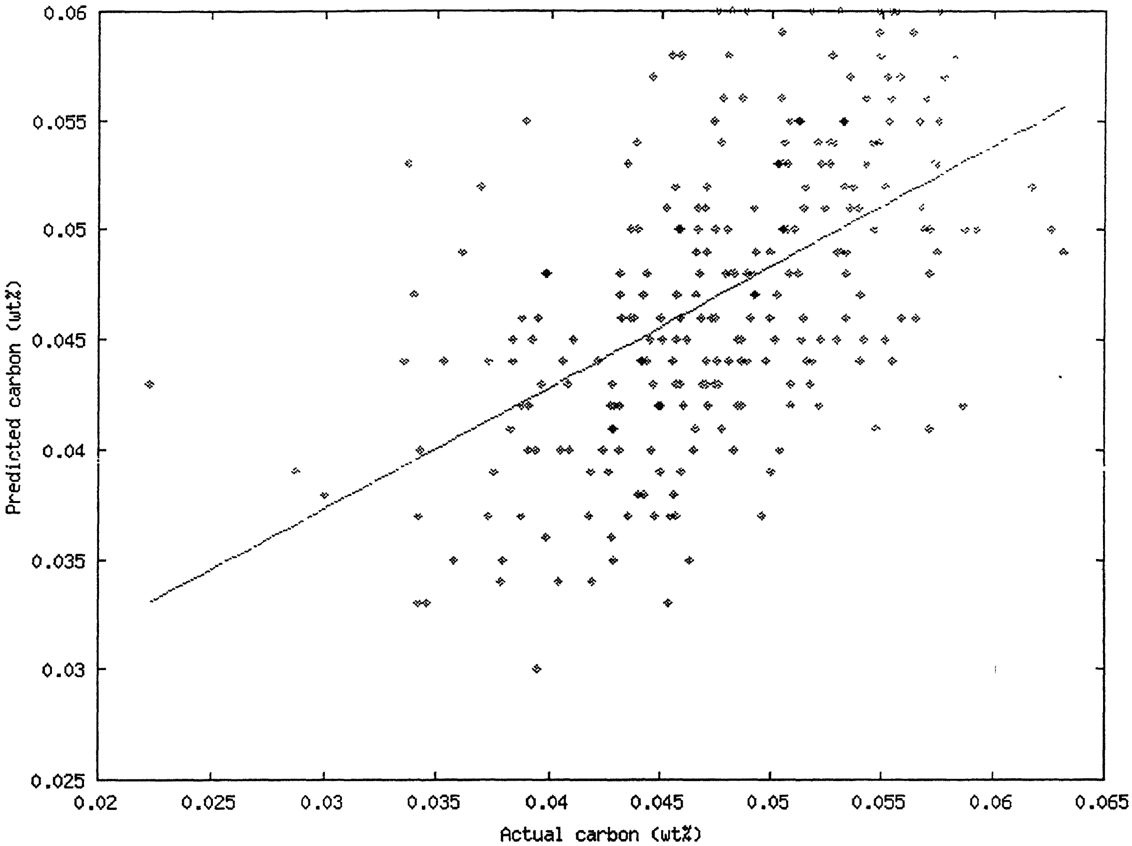

Fig 4.6 Predicted versus actual carbon using exponential models described in Tables 4.16-4.18

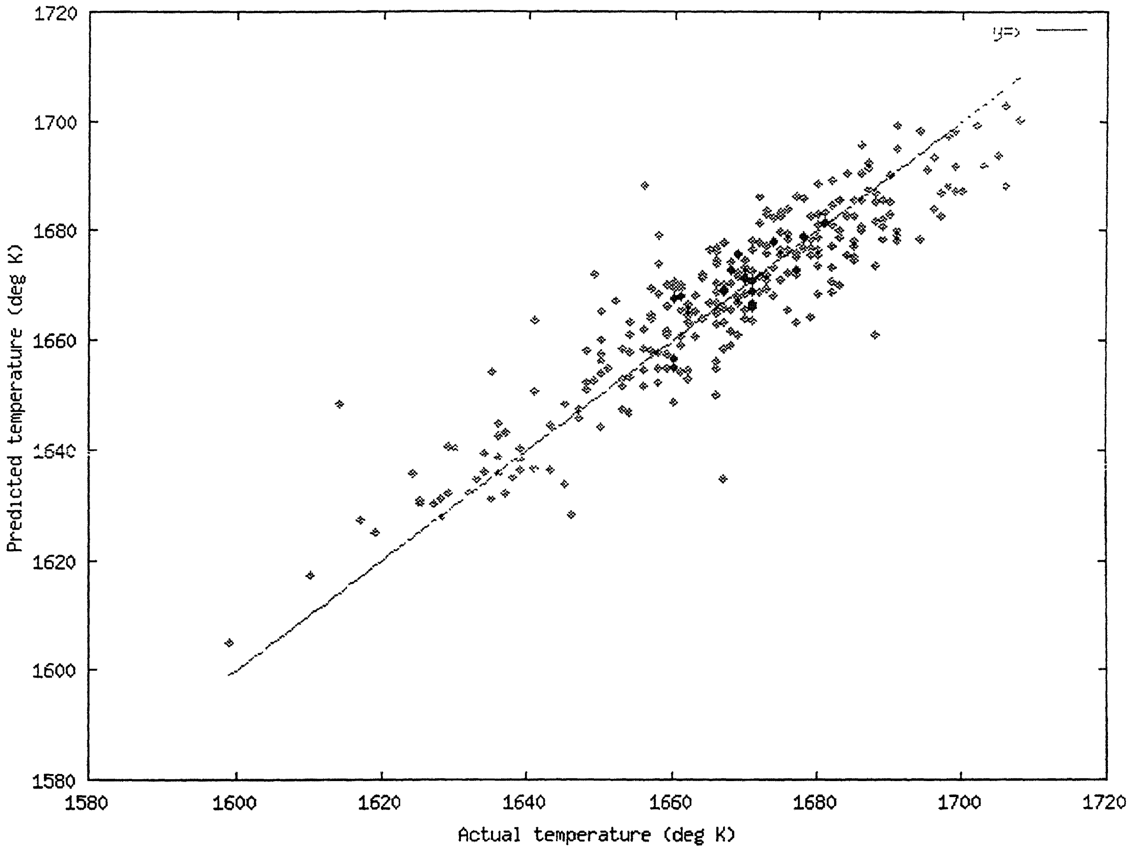

Fig 4.7 Predicted versus actual temperature for dataset D1 using linear prediction equations from Tables 4.4-4.6

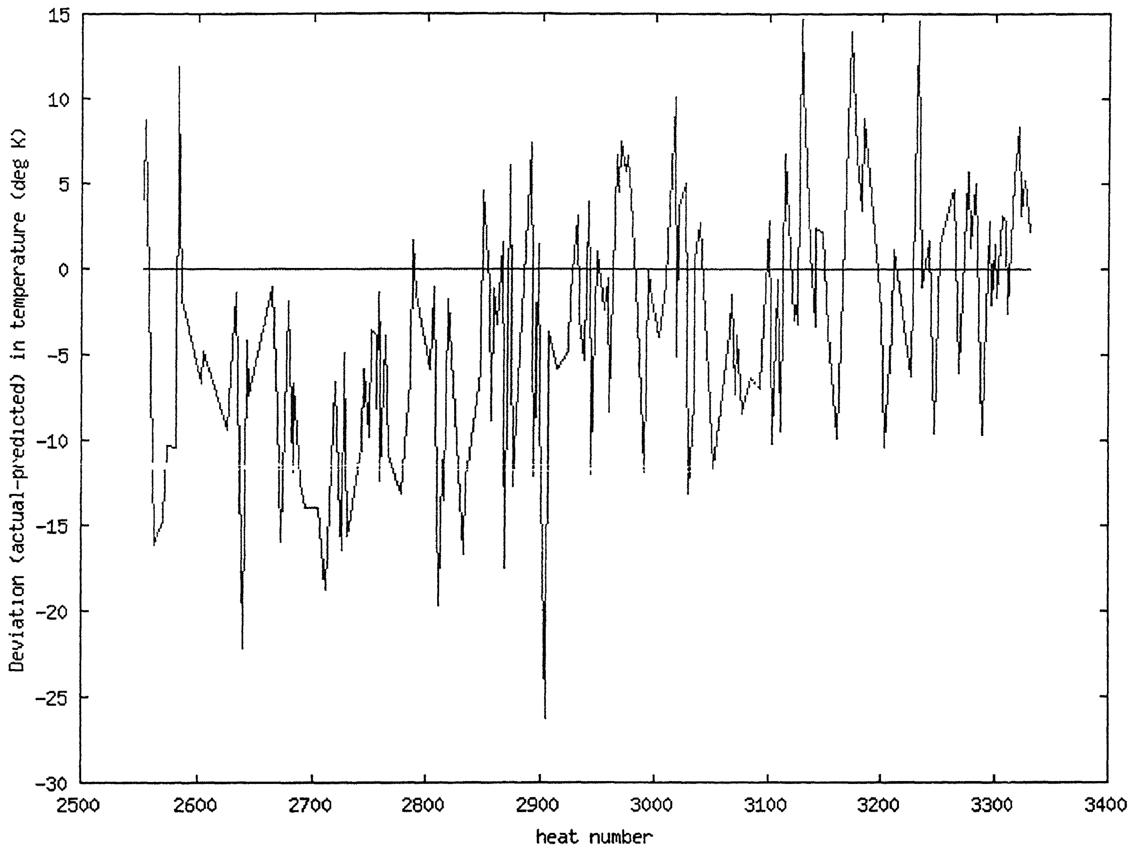

Fig 4.8 Deviation (actual-predicted) versus heat number for dataset D2 using linear prediction equations from Tables 4.4-4.6

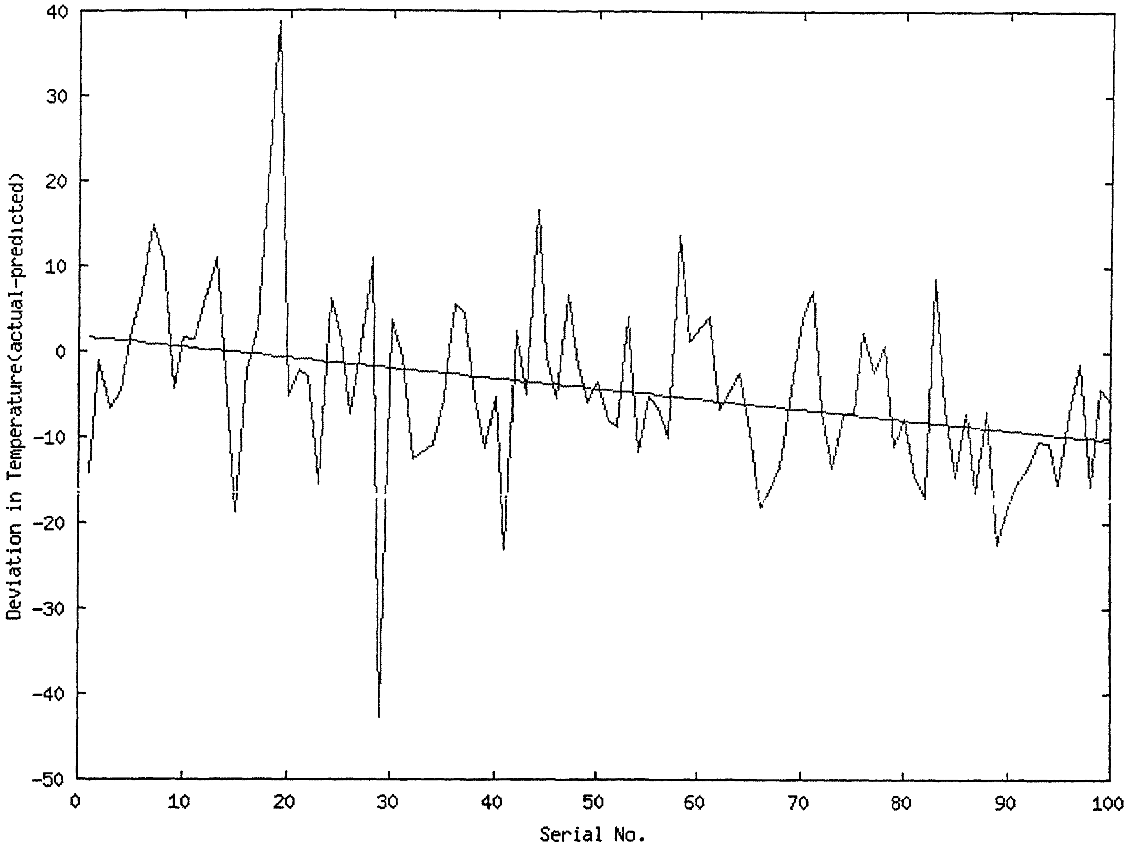

Fig 4.9 Deviation (actual-predicted) versus heat number for dataset D2 using linear prediction equations from Tables 4.4-4.6

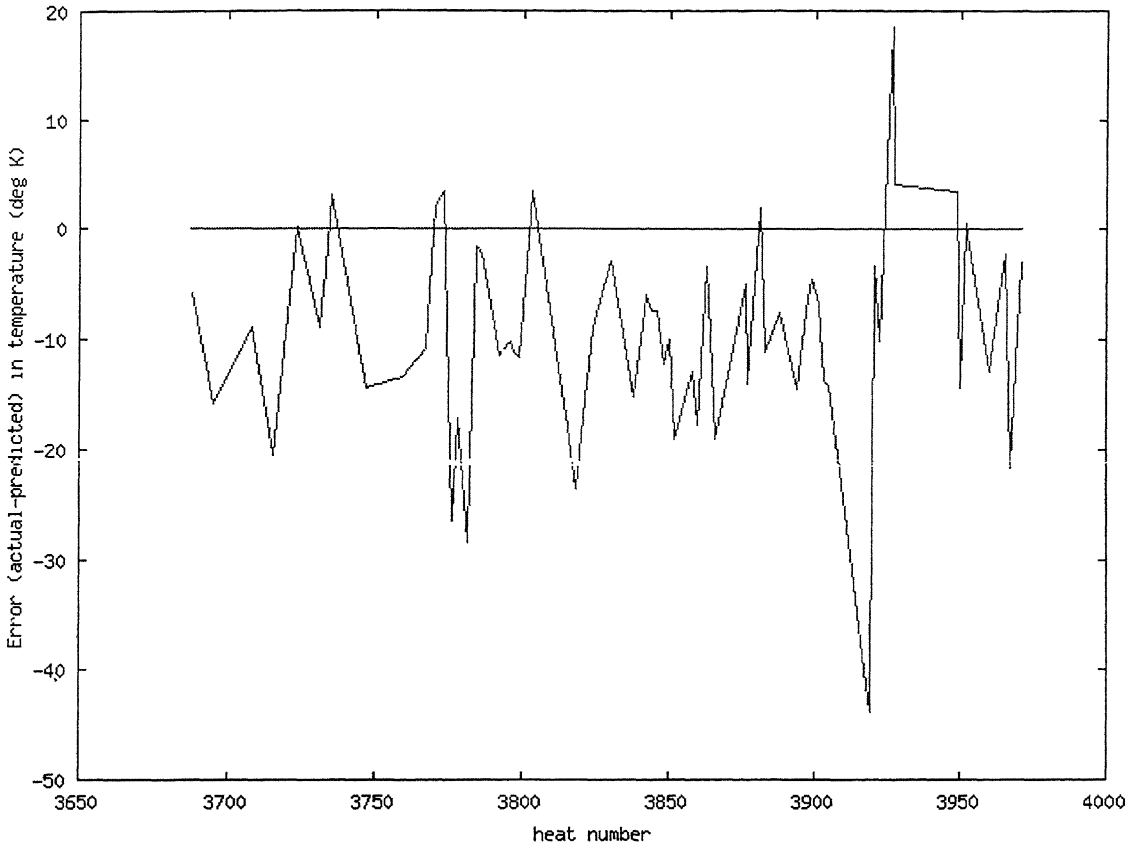

Fig 4.10 Deviation (actual-predicted) versus heat number for dataset D4 using linear prediction equations from Tables 4.4-4.6

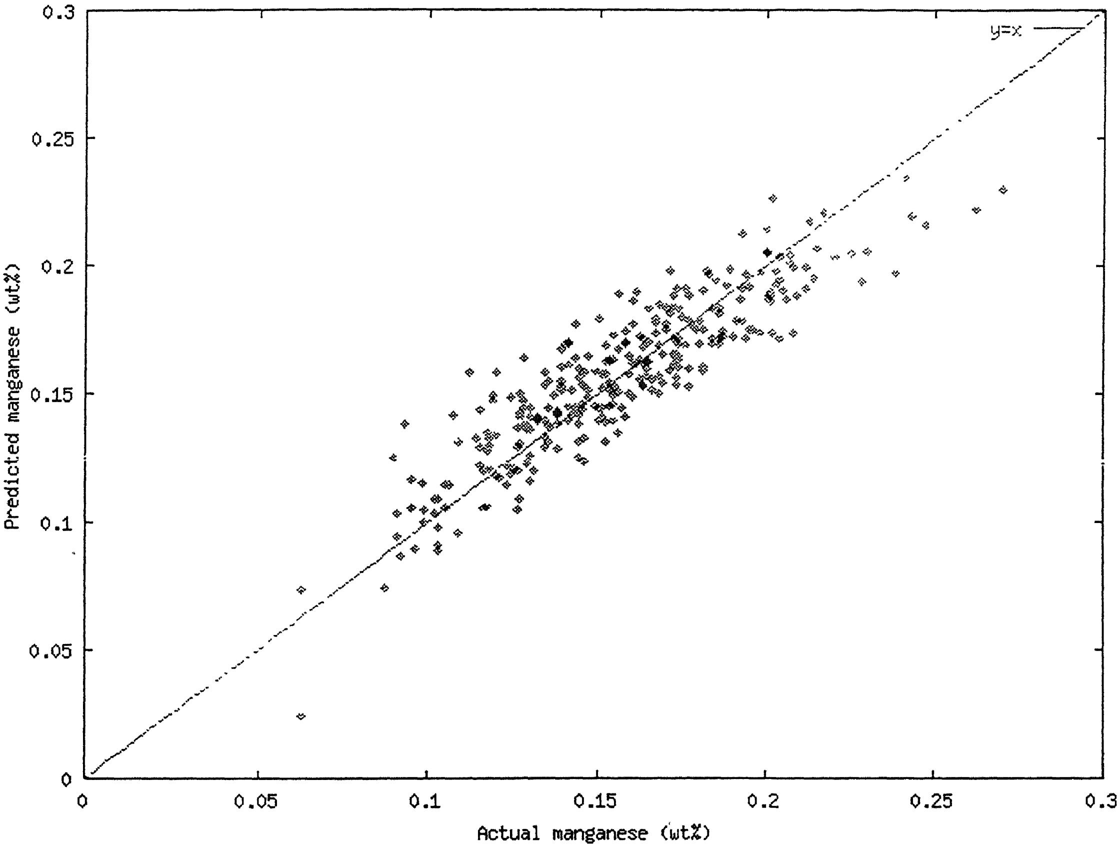

Fig 4.11 Predicted versus actual manganese for dataset D1 using linear prediction equations from Tables 4.7-4.9

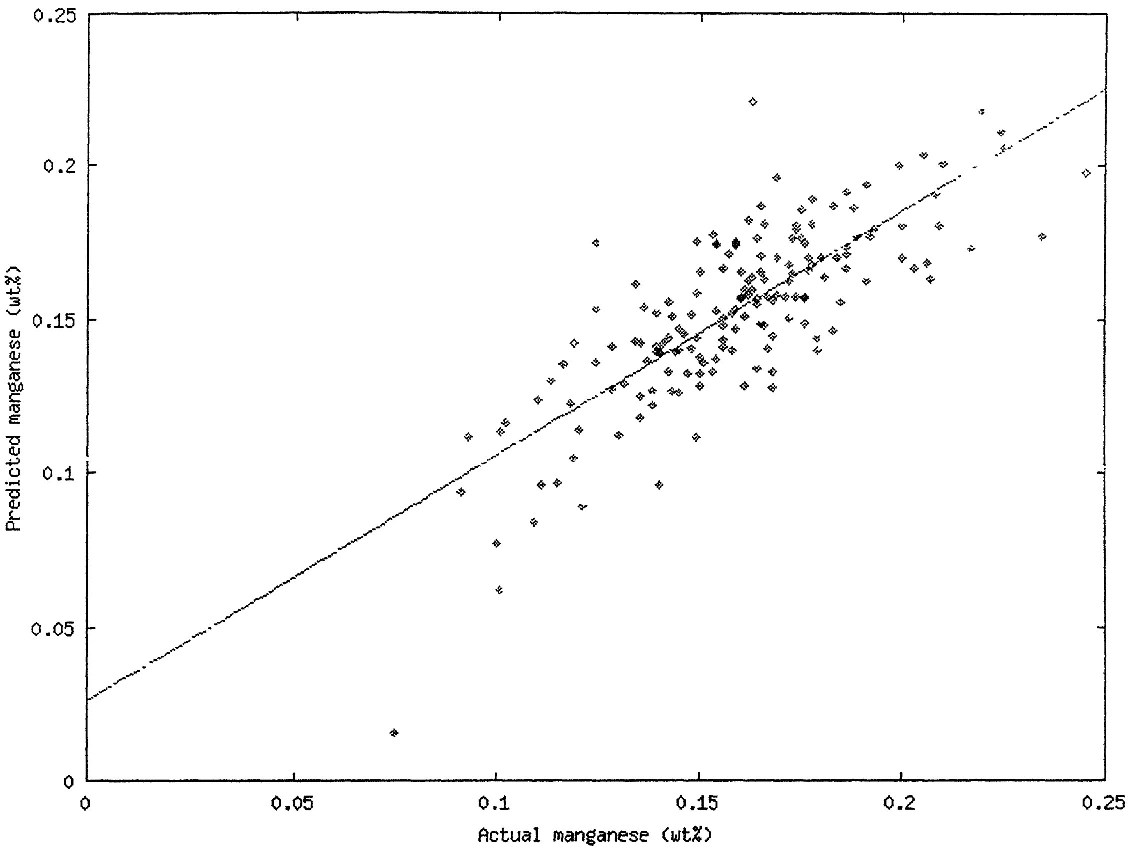

Fig 4.12 Predicted versus actual manganese for dataset D2 using linear prediction equations from Tables 4.7-4.9

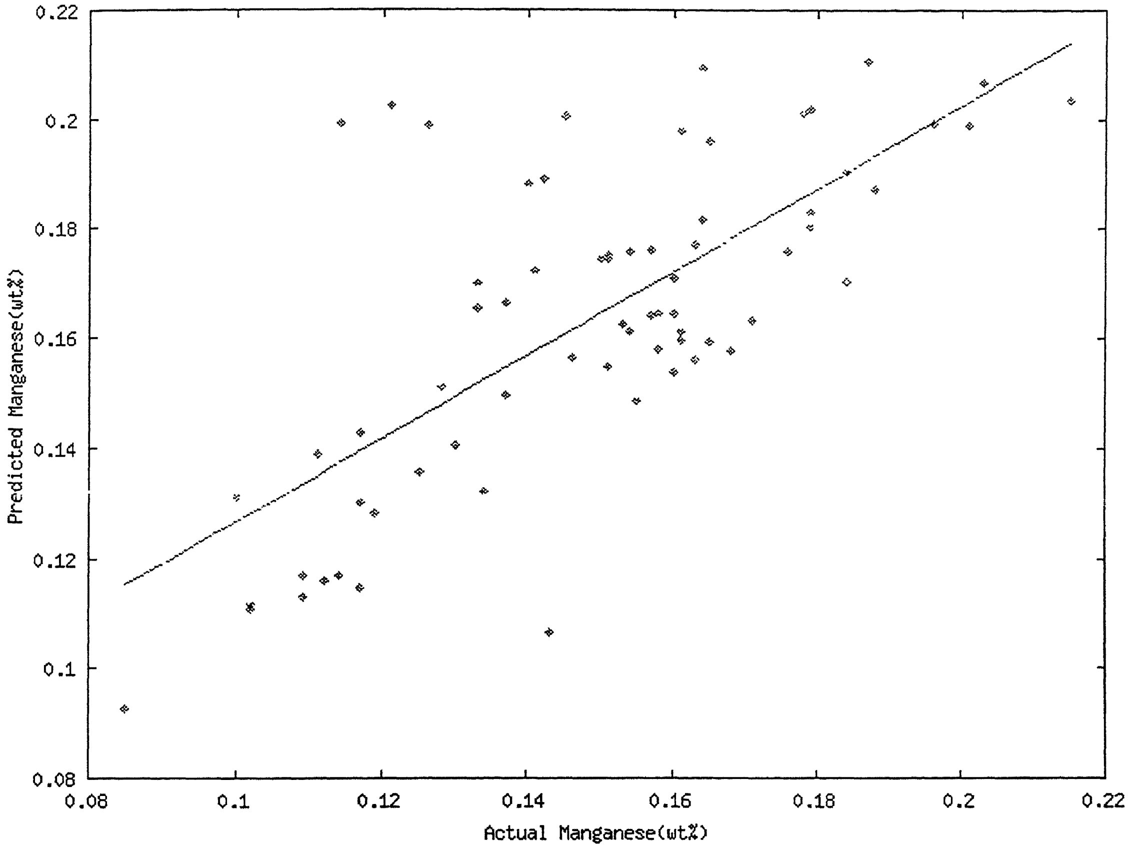

Fig 4.13 Predicted versus actual manganese for dataset D3 using linear prediction equations from Tables 4.7-4.9

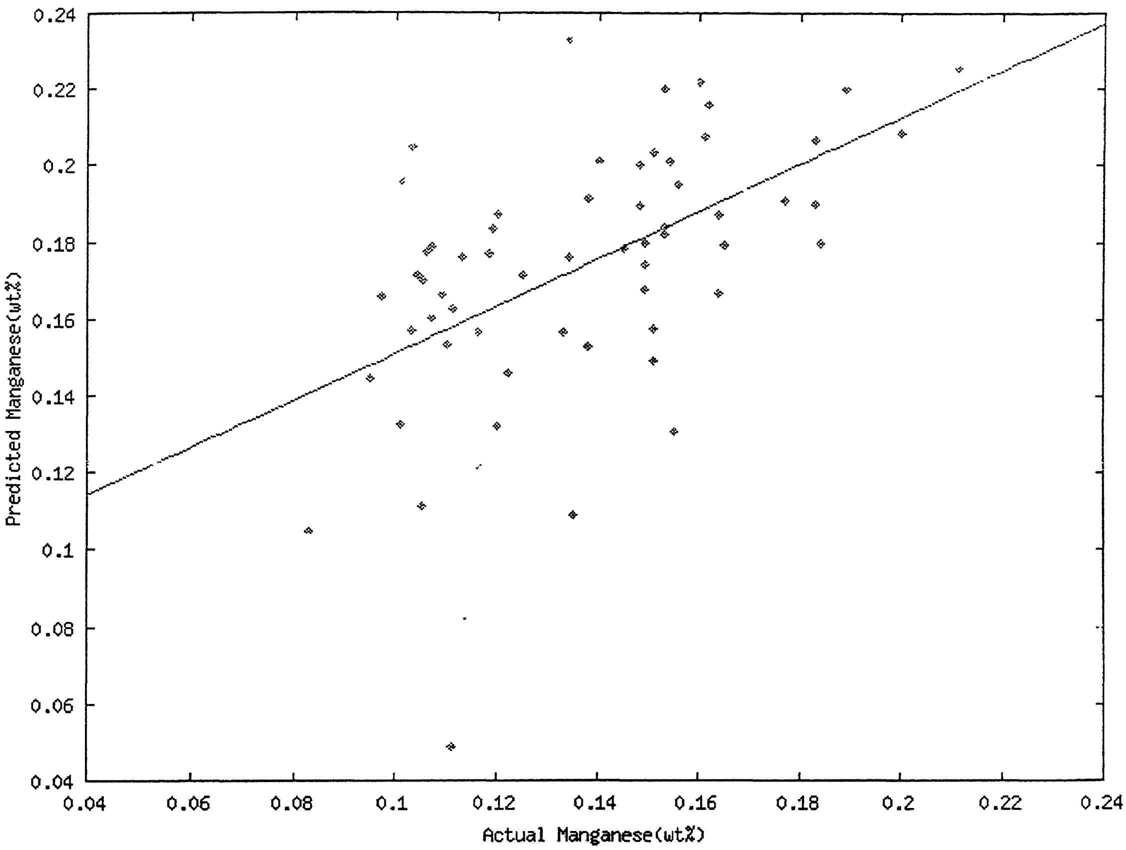

Fig 4.14 Predicted versus actual manganese for dataset D4 using linear prediction equations from Tables 4.7-4.9

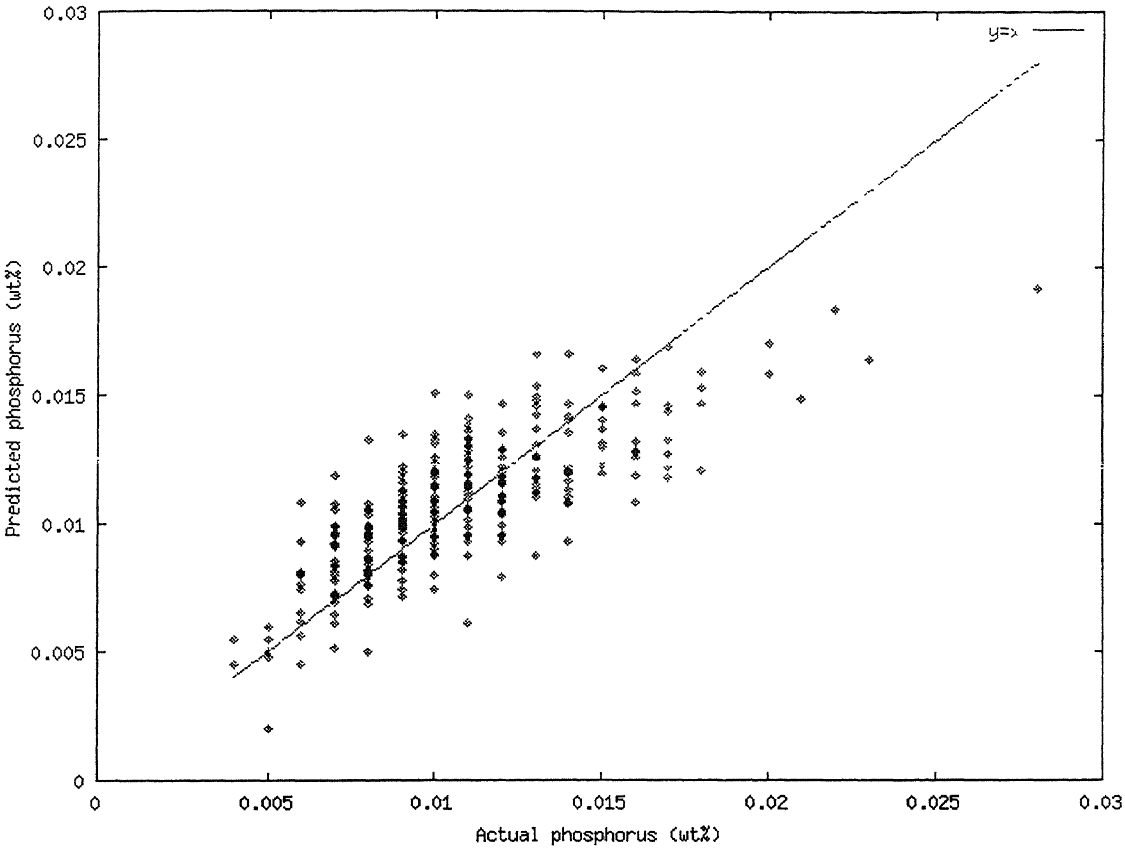

Fig 4.15 Predicted versus actual phosphorus for dataset D1 using linear prediction equations from Tables 4.10-4.12

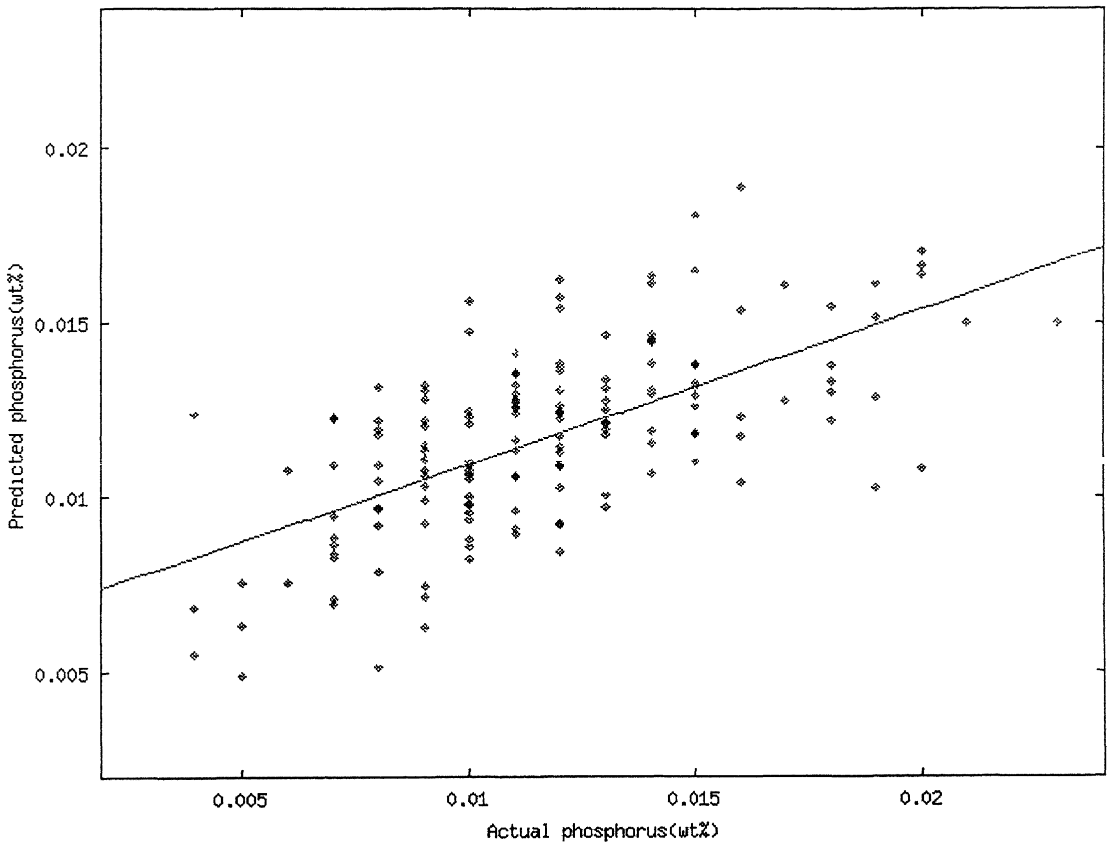

Fig 4.16 Predicted versus actual phosphorus for dataset D2 using linear prediction equations from Tables 4.10-4.12

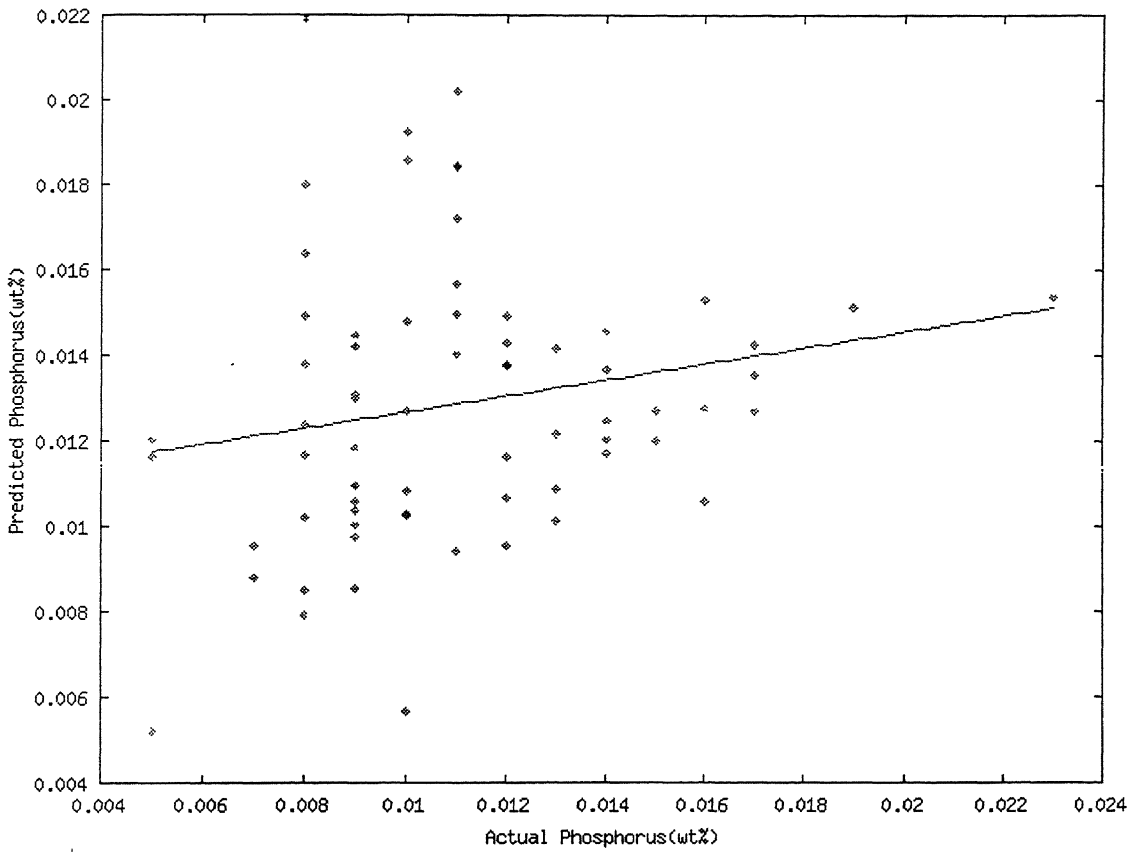

Fig 4.17 Predicted versus actual phosphorus for dataset D3 using linear prediction equations from Tables 4.10-4.12

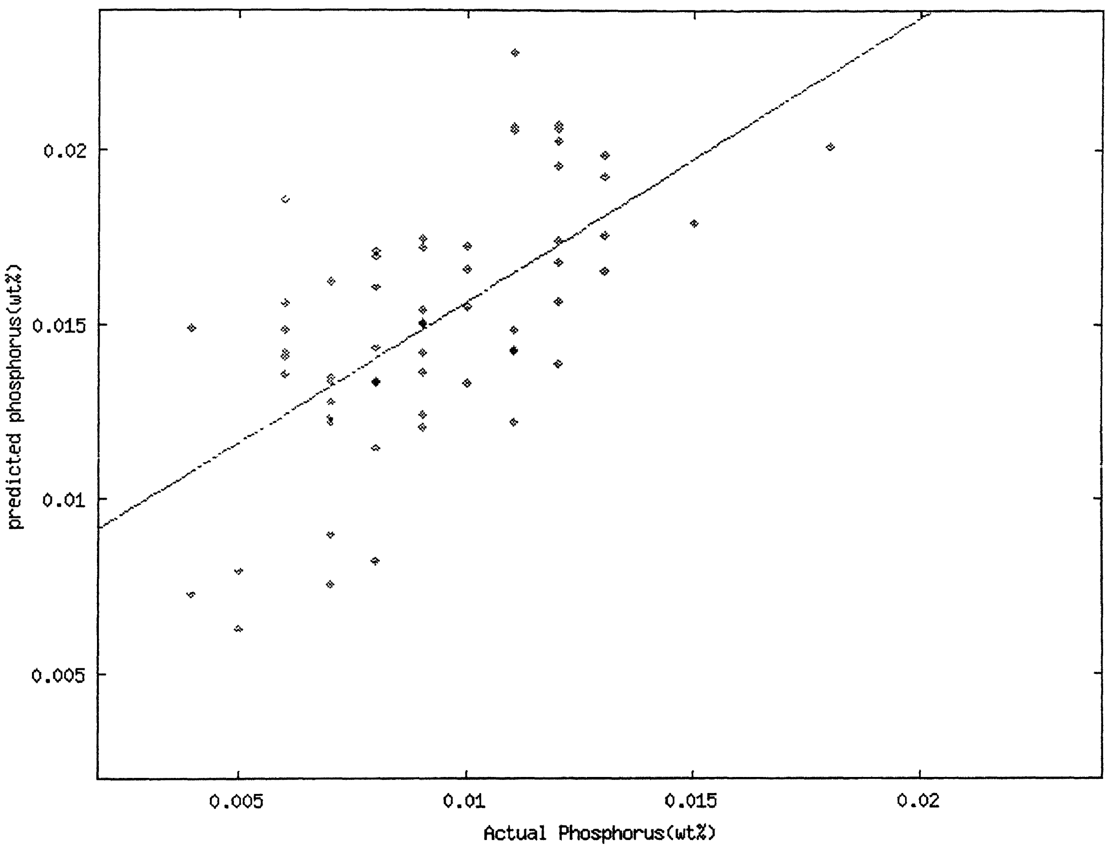

Fig 4.18 Predicted versus actual phosphorus for dataset D4 using linear prediction equations from Tables 4.10-4.12

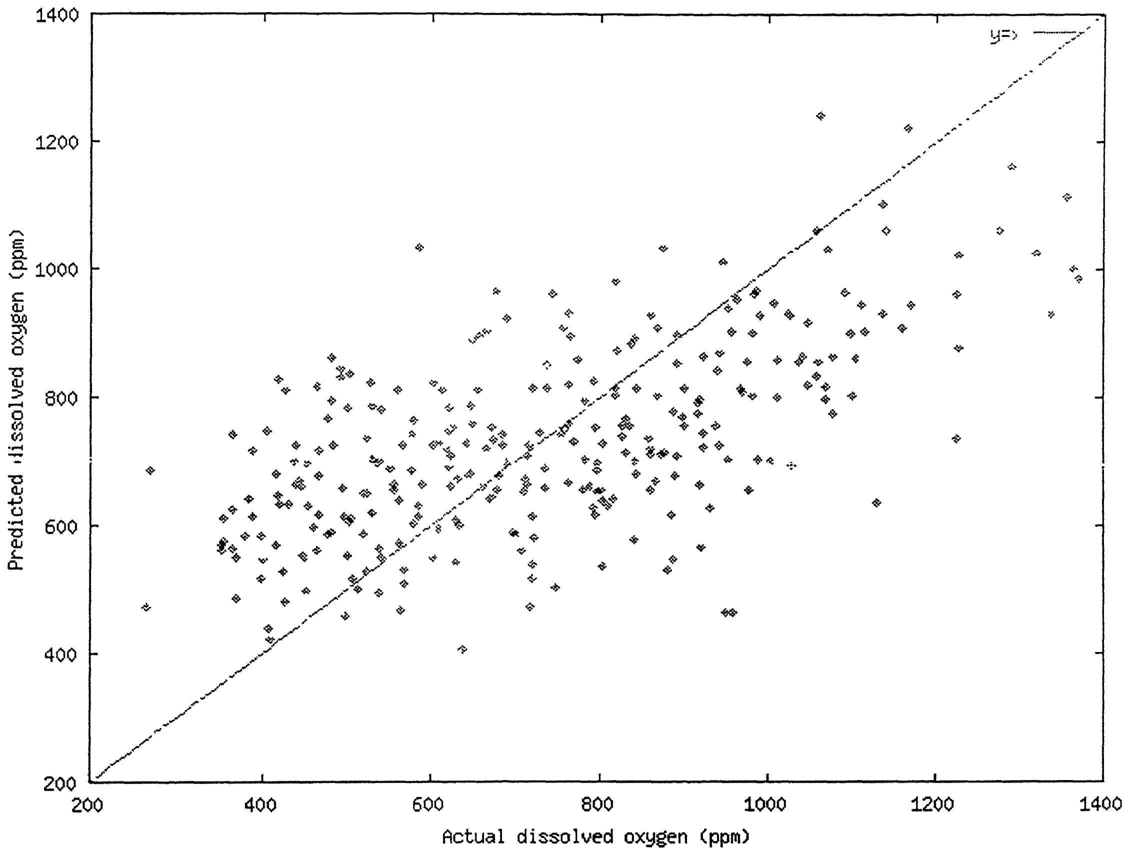

Fig 4.19 Predicted versus actual dissolved oxygen for dataset D1 using linear prediction equations from Tables 4.13-4.15

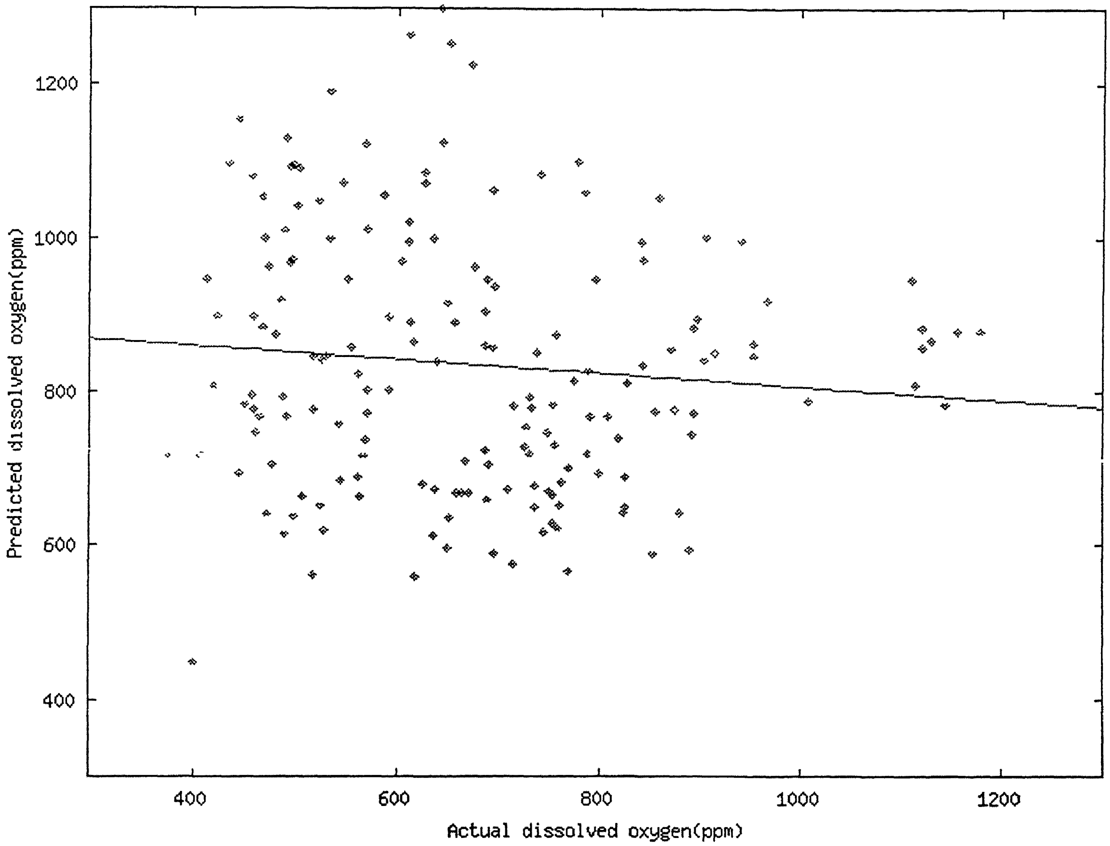

Fig 4.20 Predicted versus actual dissolved oxygen for dataset D2 using linear prediction equations from Tables 4.13-4.15

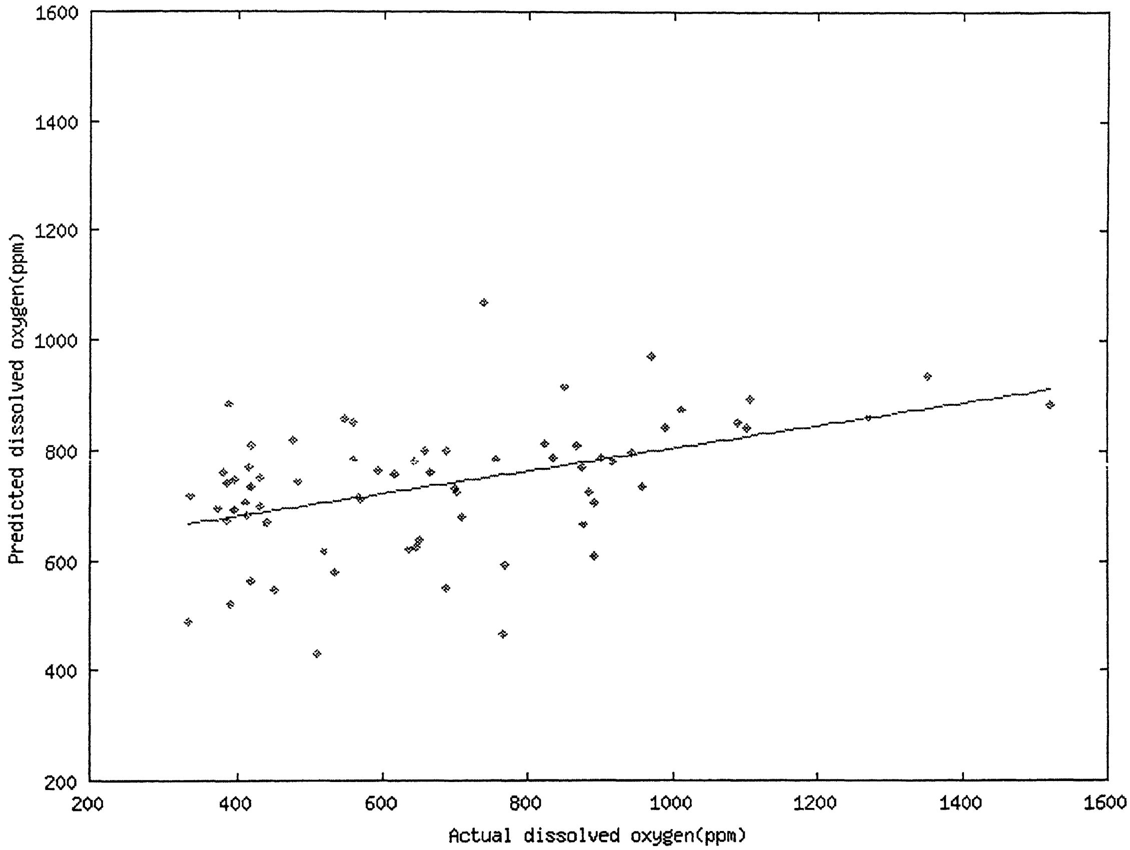

Fig 4.21 Predicted versus actual dissolved oxygen for dataset D3 using linear prediction equations from Tables 4.13-4.15

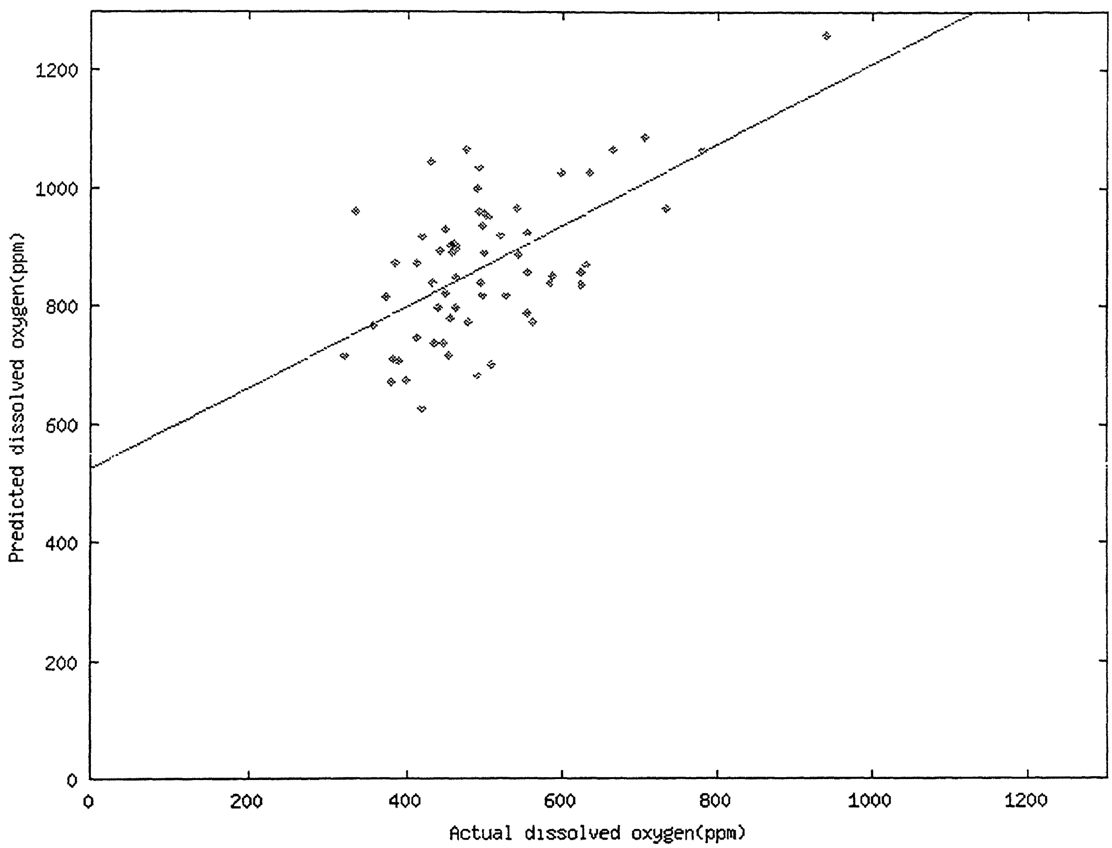

Fig 4.22 Predicted versus actual dissolved oxygen for dataset D4 using linear prediction equations from Tables 4.13-4.15

are zero for most of the heats in datasets D2, D3, D4. We used their old coefficient to incorporate them in linear prediction models. Table 4.18 gives the heats included in each run.

Coefficients of various terms obtained in these linear regression runs are presented in Tables 4.19-4.33. In these regression runs we included only those heats in which final carbon was less than 0.060 wt% and ORE2 and RDOLO2 were not added together. Average and RMS errors in prediction using these sequential linear prediction models for the different datasets are given in Tables 4.19 to 4.23.

4.4.1 Comparison of sequential and static linear prediction models

Static linear prediction model is the model in which the linear equation once developed is used for all heats whereas in sequential linear regression, we keep on updating the data file for regression and the equations keep on changing as we proceed in time. Tables 4.19-4.23 give the errors in prediction for different datasets using static linear prediction models. Tables 4.40-4.44 give the corresponding errors for sequential linear prediction models. We see an improvement in prediction for all the dataset, but still the errors in prediction for dataset D4 are quite high while D2 and D3 settle to almost comparable errors at quite lower values. Thus we can say either the sequential model in not able to incorporate very sudden changes in converter conditions or there are some errors in the data of dataset D4. The sequential model can not account for very steep changes in converter conditions, as total data points in the data file are 259 heats thus, coefficients of prediction equation represent the average converter condition over these 259 heats.

4.4.2 Trends in coefficients in sequential linear prediction models

Coefficients of various terms in different prediction equations for group 1 (ORE2=0, RDOLO2=0) are plotted in Figs 4.38-4.67. We find pattern in some of the plots. In some of the plots we observe linear or exponential aging of the coefficients (Figs 4.40, 4.42, 4.43, 4.45, 4.46, 4.47, 4.48, 4.49, 4.51, 4.53, 4.54, 4.55, 4.57, 4.60, 4.61, 4.63, 4.65,

4.67). But in some of the plots we see that coefficients vary drastically from run to run (Figs 4.38, 4.39, 4.41, 4.44, 4.62). By examining the datasets we see that range and average values of lance height vary appreciably from run to run. This can cause the unexpected changes in the coefficients of lance height. Due to interaction of other variables with lance height their coefficients can also show some unexpected patterns. In some plots (for example Figs 4.47, 4.48, 4.54, 4.57) we see a sudden break at last run (RUN#5 mean index=370) from previous trends. This suggests that there may be some errors in the dataset D4. Predictions for dataset were also not as good as predictions for D1,D2 and D3, further strengthening the chances of error in dataset D4.

4.5 Sequential linear prediction models for direct blow

Sublance measurements before a few minutes of the end of blow, lowers productivity by some amount, as oxygen flow has to be reduced during the sublance measurement. Also the cost of sublance is high. This gives motivation for direct blow heats in which we can achieve the target end point composition and temperature without any sublance measurement. We developed sequential linear prediction models for direct blow. Tables 4.45-4.46 give the coefficients of different variables obtained in these runs. We developed these equations for carbon and temperature only. We used those heats only for which actual end point carbon was less than 0.060%. A total of 593 heats were used in these models. Regression data file of 173 heats was used and it was updated after every 60 heats.

4.5.1 Predictions from direct blow models

Plot of actual versus predicted end point carbon is shown in Fig 6.68. RMS error of prediction for end point carbon is 0.006248%. Plot of actual versus predicted end point temperature is shown in Fig 6.69. RMS error of end point temperature prediction is 12.611 degrees Kelvin. Thus, we see that these error values are higher than the error in prediction models using sublance information, but these error values can be acceptable for certain grades of steel where composition and temperature control are not that crucial.

Table 4.24

Heats included in each run of sequential Linear prediction models

RUN#	Heat# included	Index# of heats
1	1739-2555	1-259
2	1886-2854	61-319
3	2015-3100	121-379
4	2144-3397	181-439
5	2458-3688	241-499

Table 4.25 Coefficients of various terms in linear prediction equation for C2 for different runs (Group 1)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
C1	3.7547e-02	4.3884e-02	3.9272e-02	3.2606e-02	3.9905e-02
O22	-1.284e-05	-1.335e-05	-1.289e-05	-1.242e-05	-1.418e-05
SVOL	3.3000e-07	4.0100e-07	3.2000e-07	3.3800e-07	5.4800e-07
CONSTANT	5.2936e-02	5.0269e-02	5.2450e-02	5.2164e-02	5.0222e-02

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.26 Coefficients of various terms+ in linear prediction equation for T2 for different runs (Group 1)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	9.4154e-01	9.3108e-01	8.8440e-01	8.6104e-01	8.3777e-01
O22	4.2094e-02	4.1058e-02	4.1138e-02	3.9923e-02	3.8288e-02
HL2	6.6050e-02	1.0809e-01	7.6306e-02	1.1497e-01	8.6283e-02
HTR	9.8168e-01	1.9046e-01	2.3149e-01	1.5181e+00	3.0257e+00
CONSTANT	6.1880e+01	7.6057e+01	1.5600e+02	1.8235e+02	2.1992e+02

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0
+Coefficient of LIM2 = -0.011978433

Table 4.27 Coefficients of various terms in linear prediction equation for Mn2 for different runs (Group 1)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
Mn0	2.9978e-01	2.1550e-01	1.4708e-01	8.7420e-02	1.3634e-01
T1	7.4701e-04	8.8240e-04	9.1087e-04	9.1927e-04	8.7872e-04
C1	1.7199e-01	1.9277e-01	1.8459e-01	1.9037e-01	2.0388e-01
O22	-3.747e-05	-3.248e-05	-2.761e-05	-2.865e-05	-3.466e-05
HL2	1.2797e-04	7.2790e-05	-1.173e-05	-1.139e-04	-1.698e-04
C2	1.2535e+00	1.2091e+00	1.7922e+00	1.7098e+00	1.4425e+00
SVOL	-2.523e-06	-2.690e-06	-2.920e-06	-2.913e-06	-3.700e-06
HTR	-3.680e-03	-5.065e-03	-6.632e-03	-7.113e-03	-6.009e-03
BAS	3.9826e-03	2.4921e-03	2.0752e-03	3.2387e-04	3.9166e-04
CONSTANT	-1.167e+00	-1.332e+00	-1.352e+00	-1.309e+00	-1.224e+00

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0

Table 4.28 Coefficients of various terms+ in linear prediction equation for P2 for different runs (Group 1)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
P0	2.3330e-01	1.4727e-01	9.9392e-02	1.3506e-01	2.3855e-02
HL2	-1.973e-05	-1.889e-05	1.6120e-06	2.2424e-05	2.2545e-05
T2	5.0833e-05	3.5107e-05	3.1538e-05	3.7055e-05	1.0108e-05
C2	-4.483e-02	-1.056e-01	-1.205e-01	-1.325e-01	-1.274e-01
Mn2	6.3288e-02	7.7672e-02	9.0919e-02	9.2687e-02	1.0423e-01
SVOL	-2.410e-07	-1.290e-07	-1.800e-07	-2.620e-07	-1.590e-07
HTR	1.6742e-04	4.7225e-04	5.0958e-04	6.8651e-04	1.0596e-03
CONSTANT	-8.730e-02	-6.010e-02	-5.604e-02	-7.003e-02	-2.430e-02

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0
+Coefficient of DOLO2 = 0.000001519

Table 4.29 Coefficients of various terms+ in linear prediction equation for Oact2 for different runs (Group 1)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
HL2	-2.787e+00	1.4274e+00	4.0442e+00	5.6453e+00	5.4662e+00
C2	-2.185e+04	-1.935e+04	-1.922e+04	-2.304e+04	-2.422e+04
CONSTANT	2.4004e+03	1.3533e+03	7.8701e+02	6.5441e+02	7.5457e+02

*Group 1 consists of heats for which RDOLO2=0 and ORE2=0
+Coefficient of LIM2 = 0.363741457, Coefficient of DOLO2 = 0.109627701

Table 4.30 Coefficients of various terms in linear prediction equation for C2 for different runs (Group 2)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
C1	3.0486e-02	4.0233e-02	3.4390e-02	4.2803e-02	3.6468e-02
022	-1.572e-05	-1.734e-05	-1.563e-05	-1.566e-05	-1.285e-05
HL2	2.7931e-05	3.3173e-05	3.7363e-05	3.2992e-05	6.5764e-05
SVOL	5.0000e-07	5.5200e-07	1.7300e-07	1.5100e-07	-2.300e-08
CONSTANT	5.2857e-02	5.0264e-02	5.5398e-02	5.3008e-02	4.8248e-02

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.31 Coefficients of various terms+ in linear prediction equation for T2 for different runs (Group 2)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	8.9813e-01	8.6499e-01	8.1230e-01	8.1937e-01	7.9788e-01
022	3.3752e-02	3.2170e-02	3.2017e-02	3.1749e-02	3.2946e-02
RDOLO2	-8.931e-03	-8.946e-03	-8.234e-03	-7.958e-03	-1.111e-02
HL2	-3.372e-02	3.5311e-02	6.5534e-02	9.8450e-02	4.9649e-02
CONSTANT	1.7226e+02	2.1324e+02	2.9070e+02	2.7406e+02	3.1605e+02

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0
+Coefficient of LIM2 = -0.022366848, Coefficient of DOLO2 = -0.005296942, Coefficient of RSL2 = -0.009144903

Table 4.32 Coefficients of various terms+ in linear prediction equation for Mn2 for different runs (Group 2)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
Mn0	3.1602e-01	2.3045e-01	2.5028e-01	3.1495e-01	2.3651e-01
T1	1.2301e-03	8.5427e-04	9.2976e-04	8.8884e-04	6.7657e-04
C1	2.0252e-01	1.6336e-01	1.6239e-01	1.2708e-01	1.6722e-01
022	-3.503e-05	-3.721e-05	-2.931e-05	-2.512e-05	-4.275e-05
RDOLO2	-1.876e-05	-1.595e-05	-1.424e-05	-1.520e-05	-1.868e-05
T2	-2.234e-04	1.7363e-04	1.5941e-04	5.9517e-05	-9.859e-05
C2	1.1846e+00	1.3628e+00	1.6019e+00	1.4779e+00	4.3475e-01
SVOL	-3.771e-06	-4.069e-06	-4.022e-06	-4.371e-06	-8.210e-07
BAS	-2.496e-03	-2.756e-03	-1.293e-03	-1.976e-03	2.7317e-03
CONSTANT	-1.516e+00	-1.523e+00	-1.664e+00	-1.436e+00	-8.312e-01

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0
+Coefficient of DOLO2 = -0.000005231

Table 4.33 Coefficients of various terms in linear prediction equation for P2 for different runs (Group 2)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
P0	2.2453e-01	2.0559e-01	5.9080e-02	1.1727e-01	-2.344e-01
HL2	-3.057e-05	-2.240e-05	-8.175e-06	1.3528e-05	1.1758e-05
T2	8.8712e-05	7.3694e-05	6.1296e-05	5.3743e-05	2.0978e-05
C2	4.4940e-02	3.4248e-02	-5.893e-03	-1.367e-02	-8.718e-02
Mn2	4.4378e-02	5.5017e-02	6.7712e-02	7.5864e-02	1.0021e-01
SVOL	-3.760e-07	-2.980e-07	-3.400e-07	-3.360e-07	-9.200e-08
CONSTANT	-1.445e-01	-1.233e-01	-9.652e-02	-9.182e-02	-2.199e-02

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0

Table 4.34 Coefficients of various terms in linear prediction equation for Oact2 for different runs (Group 2)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	-8.986e+00	-1.016e+01	-8.474e+00	-6.178e+00	-5.409e+00
C1	-9.646e+02	-1.031e+03	-7.874e+02	-4.705e+02	-5.895e+02
RDOLO2	8.3450e-02	1.2050e-01	1.0726e-01	9.0109e-02	8.3956e-02
T2	1.0365e+01	1.2136e+01	9.2947e+00	7.9808e+00	5.7674e+00
C2	-9.678e+03	-4.052e+03	-3.599e+03	-6.036e+03	-7.192e+03
HTR	-3.063e+01	-3.464e+01	-2.081e+01	-2.401e+01	-1.071e+01
CONSTANT	-1.218e+03	-2.569e+03	-7.653e+02	-2.204e+03	2.6989e+02

*Group 2 consists of heats for which RDOLO2≠0 and ORE2=0
+Coefficient of LIM2 = 0.346866310, Coefficient of RSL2 = 0.161082357

Table 4.35 Coefficients of various terms+ in linear prediction equation for C2 for different runs (Group 3)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
C1	4.6433e-02	4.5302e-02	4.6350e-02	4.9363e-02	4.2695e-02
O22	-1.962e-05	-1.559e-05	-1.557e-05	-1.253e-05	-1.163e-05
ORE2	5.8350e-06	3.3370e-06	2.8580e-06	5.2360e-06	1.2500e-07
HL2	1.5929e-04	6.4107e-05	4.4504e-05	2.8412e-05	6.3175e-05
CONSTANT	3.2933e-02	4.7801e-02	5.1027e-02	4.5188e-02	4.3186e-02

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0
+Coefficient of LIM2 = -0.000018092

Table 4.36 Coefficients of various terms+ in linear prediction equation for T2 for different runs (Group 3)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
T1	9.4805e-01	8.5877e-01	8.8292e-01	8.9918e-01	8.5656e-01
O22	4.4258e-02	3.9606e-02	3.7683e-02	3.6983e-02	3.5667e-02
ORE2	-2.229e-02	-2.091e-02	-1.677e-02	-1.708e-02	-1.288e-02
HL2	-7.676e-02	6.1619e-02	1.0731e-01	1.1449e-01	3.5690e-02
HTR	1.9170e+00	1.1168e+00	4.3178e-01	7.3430e-01	4.9358e-01
CONSTANT	7.9490e+01	2.0617e+02	1.6356e+02	1.3564e+02	2.1774e+02

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0
+Coefficient of RSL2 = -0.006884490

Table 4.37 Coefficients of various terms+ in linear prediction equation for Mn2 for different runs (Group 3)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
Mn0	2.4597e-01	2.2094e-01	2.1517e-01	3.2295e-01	7.2071e-02
T1	1.0135e-03	1.0879e-03	9.7712e-04	1.2038e-03	6.3331e-04
C1	1.9585e-01	2.2574e-01	2.2954e-01	2.0347e-01	2.4715e-01
O22	-2.831e-05	-3.032e-05	-3.766e-05	-2.322e-05	-5.743e-05
RDOLO2	-2.789e-05	-2.000e-05	-1.019e-05	-1.175e-05	-2.208e-05
T2	4.1075e-05	-2.801e-04	-1.045e-04	-2.647e-04	3.1814e-04
C2	1.7196e+00	1.0481e+00	1.2351e+00	1.3345e+00	-1.736e-01
SVOL	-3.023e-06	-3.090e-06	-3.298e-06	-3.489e-06	3.3500e-07
BAS	-5.209e-03	-1.035e-03	-1.156e-03	8.9613e-04	1.9298e-03
CONSTANT	-1.618e+00	-1.188e+00	-1.298e+00	-1.470e+00	-1.386e+00

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0
+Coefficient of LIM2= -0.000042552, Coefficient of DOLO2 = -0.000010484, Coefficient of RSL2 = -0.000003391

Table 4.38 Coefficients of various terms in linear prediction equation for P2 for different runs (Group 3)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
P0	2.4087e-01	2.2437e-01	-1.394e-02	1.0375e-01	-3.535e-02
ORE2	-1.941e-06	-1.052e-06	-4.600e-08	1.0680e-06	-5.900e-07
HL2	-4.304e-05	-2.721e-05	-2.094e-05	8.3500e-07	-4.234e-06
T2	4.2922e-05	5.6860e-05	7.0249e-05	6.3179e-05	3.4645e-05
Mn2	4.4620e-02	5.4115e-02	6.7243e-02	6.6679e-02	7.4568e-02
SVOL	-3.020e-07	-2.260e-07	-1.500e-07	-2.940e-07	-1.160e-07
CONSTANT	-6.562e-02	-9.540e-02	-1.095e-01	-1.057e-01	-5.277e-02

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

Table 4.39 Coefficients of various terms+ in linear prediction equation for Oact2 for different runs (Group 3)*

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5
ORE2	-1.420e-01	-9.347e-02	-5.738e-02	-1.005e-01	-4.707e-02
HL2	-2.218e+00	2.2330e+00	2.9733e+00	4.1144e+00	1.9671e+00
C2	-1.962e+04	-1.894e+04	-1.520e+04	-1.552e+04	-1.456e+04
CONSTANT	2.1992e+03	1.1533e+03	8.1836e+02	6.6852e+02	9.5638e+02

*Group 3 consists of heats for which RDOLO2=0 and ORE2≠0

+Coefficient of LIM2 = -0.435371697

Table 4.40 Deviation of predicted carbon (wt%) from actual carbon using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	0.00440	0.00519	0.00751
RMS deviation	0.00547	0.00638	0.00957

Table 4.41 Deviation of predicted temperature (^{0}K) from actual temperature using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	6.23	7.54	8.30
RMS deviation	7.86	9.95	10.93

Table 4.42Deviation of predicted manganese (wt%) from actual manganese using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	0.01486	0.02004	0.04101
RMS deviation	0.01963	0.02816	0.04760

Table 4.43 Deviation of predicted phosphorus (wt%) from actual phosphorus using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	0.00203	0.00388	0.00496
RMS deviation	0.00269	0.00474	0.00559

Table 4.44 Deviation of predicted dissolved oxygen (ppm) from actual dissolved oxygen using sequential linear prediction equations

Data set	D2	D3	D4
Average deviation	211.43	229.54	236.51
RMS deviation	264.09	236.51	264.78

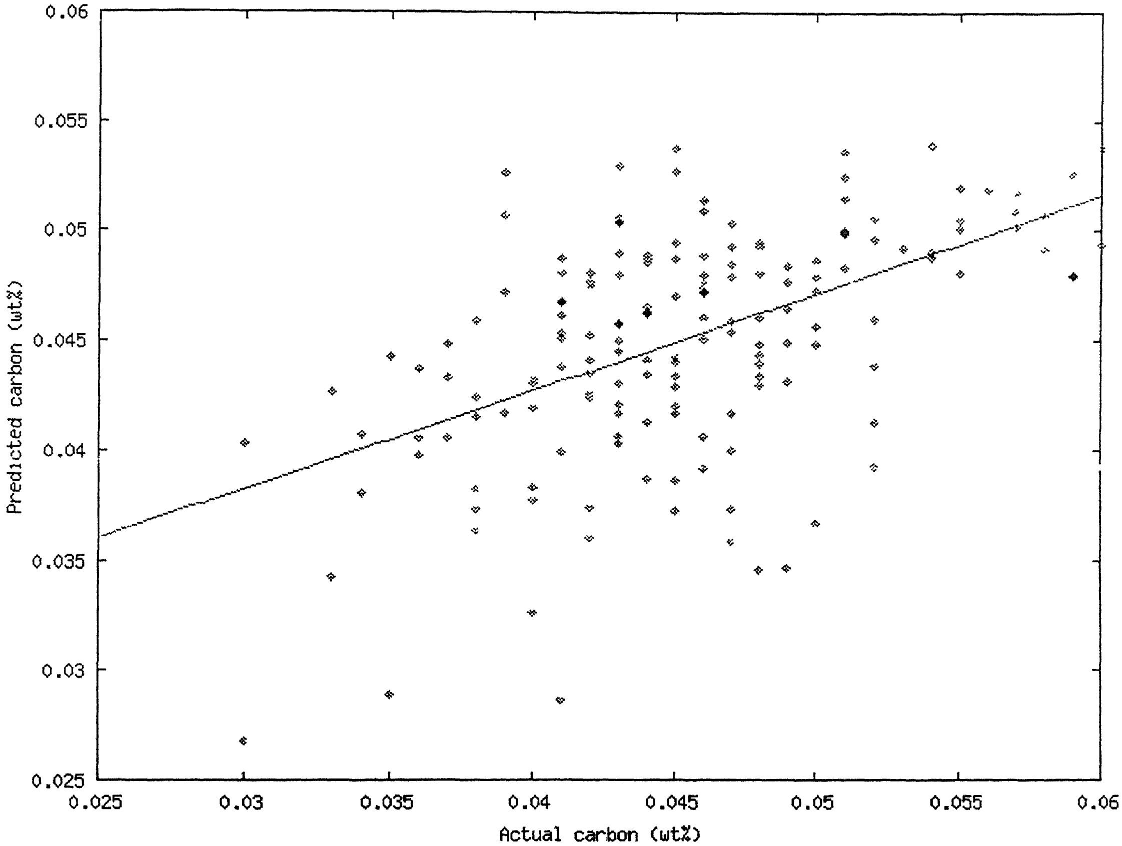

Fig 4.23 Predicted carbon versus actual carbon in wt% for dataset D2 using sequential linear prediction equations

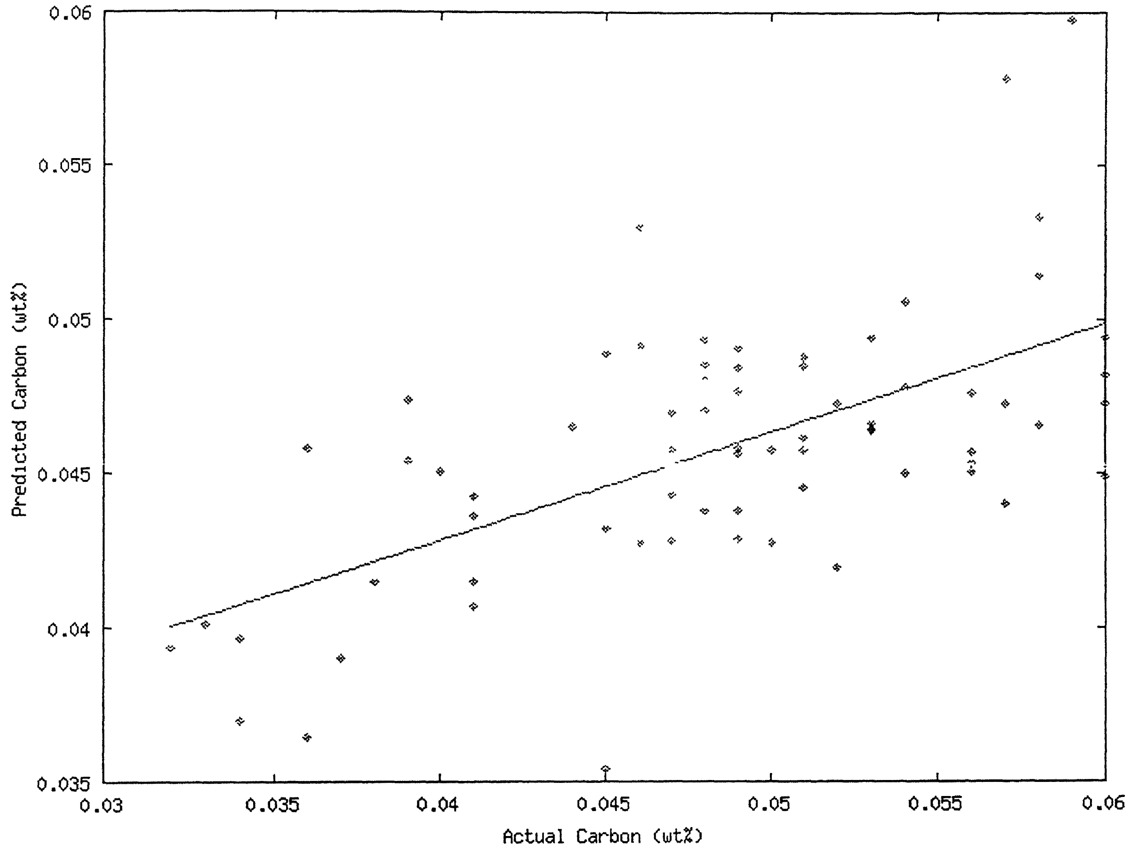

Fig 4.24 Predicted carbon versus actual carbon in wt% for dataset D3 using sequential linear prediction equations

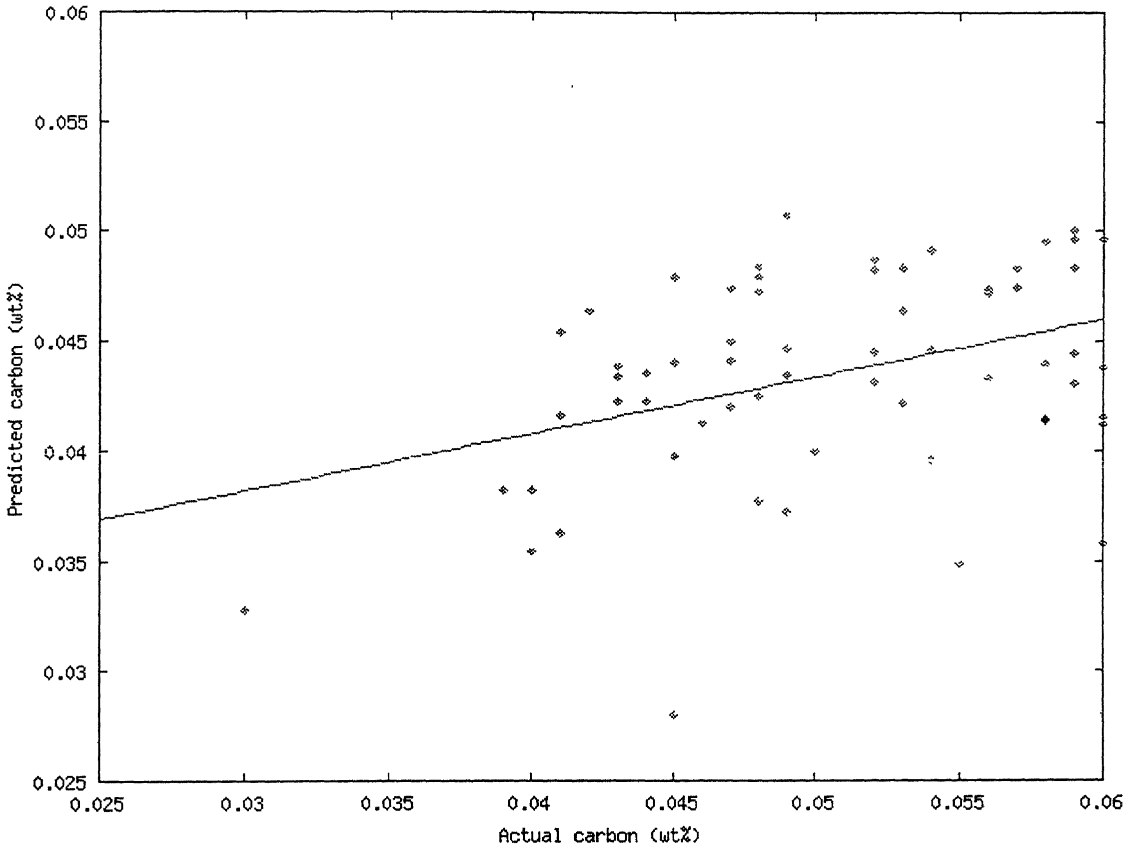

Fig 4.25 Predicted carbon versus actual carbon in wt% for dataset D4 using sequential linear prediction equations

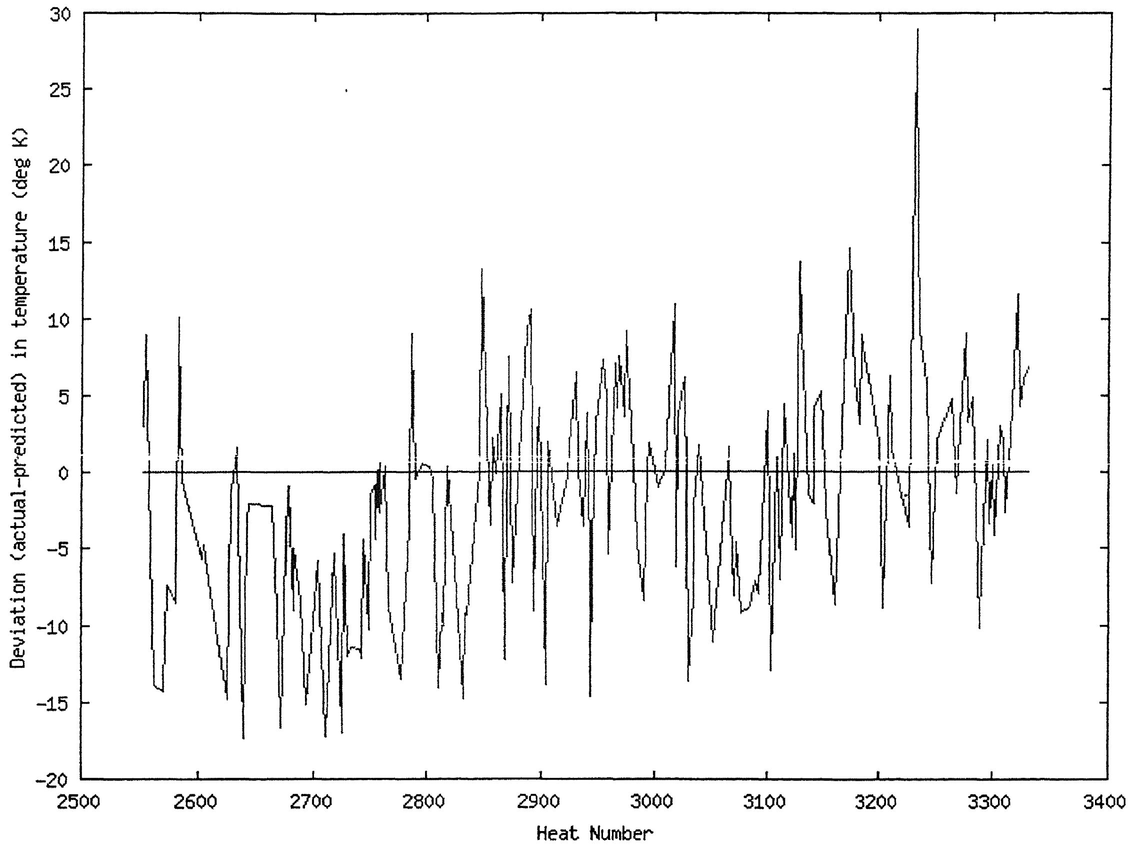

Fig 4.26 Deviation (actual-predicted) in temperature versus heat number for dataset D2 using sequential linear prediction equations

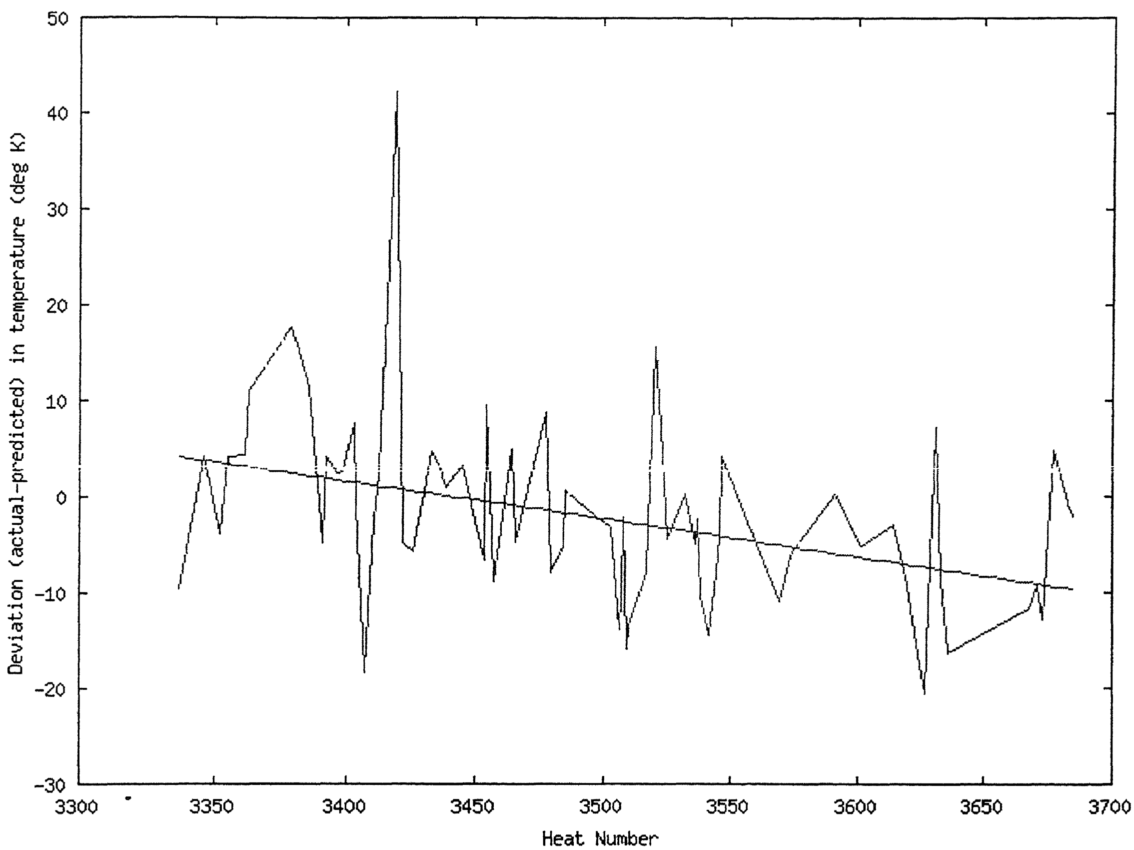

Fig 4.27 Deviation (actual-predicted) in temperature versus heat number for dataset D3 using sequential linear prediction equations

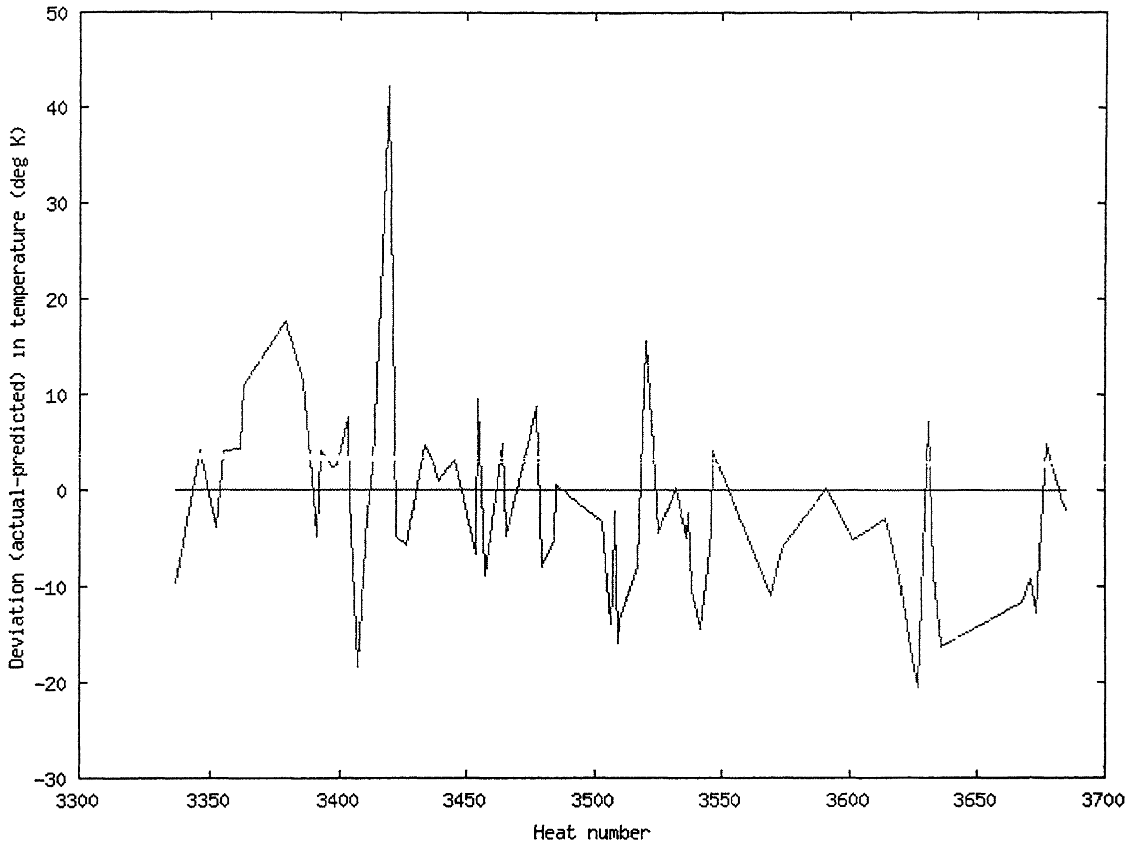

Fig 4.28 Deviation (actual-predicted) in temperature versus heat number for dataset D4 using sequential linear prediction equations

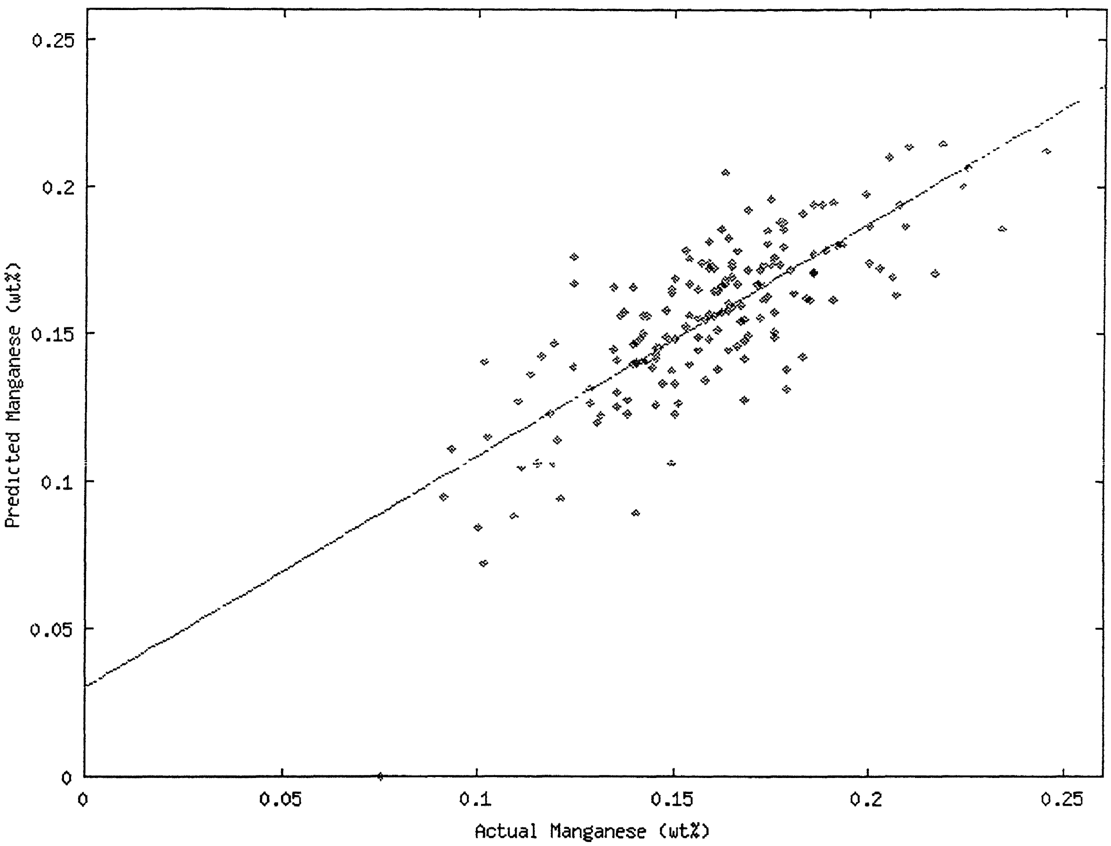

Fig 4.29 Predicted versus actual manganese for dataset D2 using sequential linear prediction equations

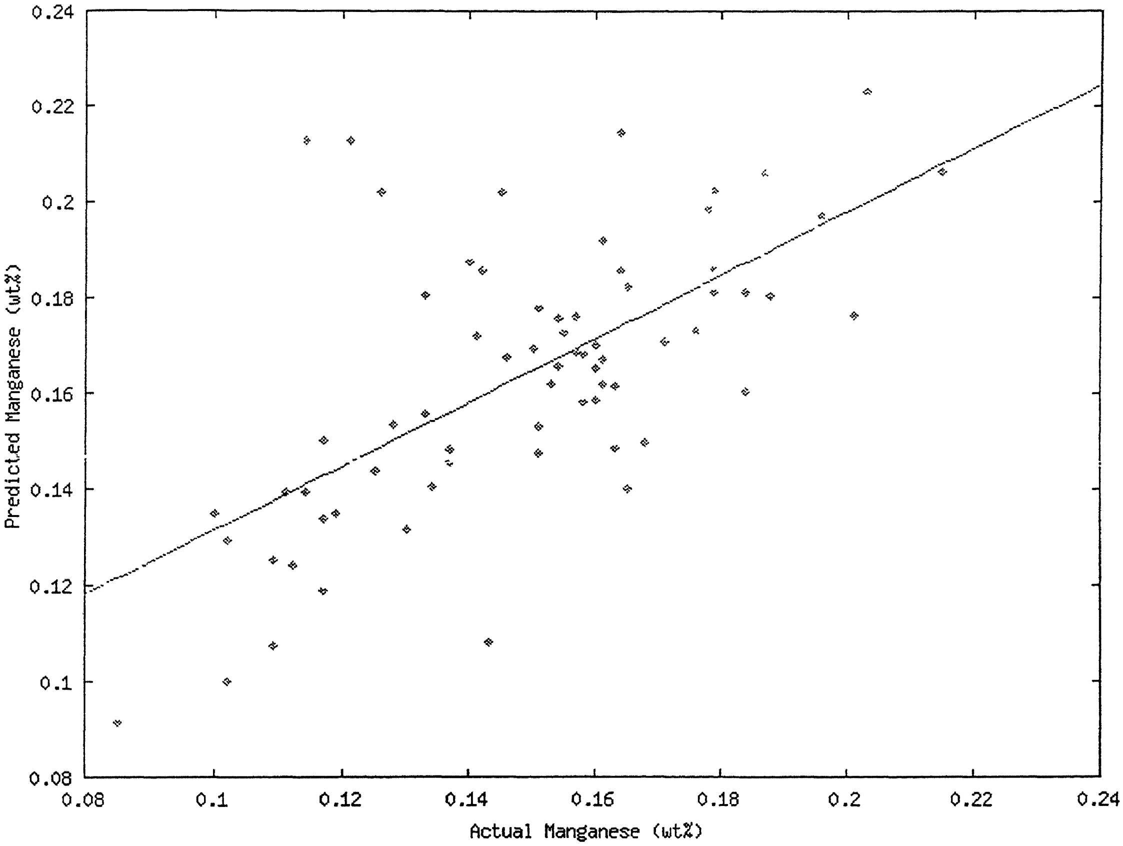

Fig 4.30 Predicted versus actual manganese for dataset D3 using sequential linear prediction equations

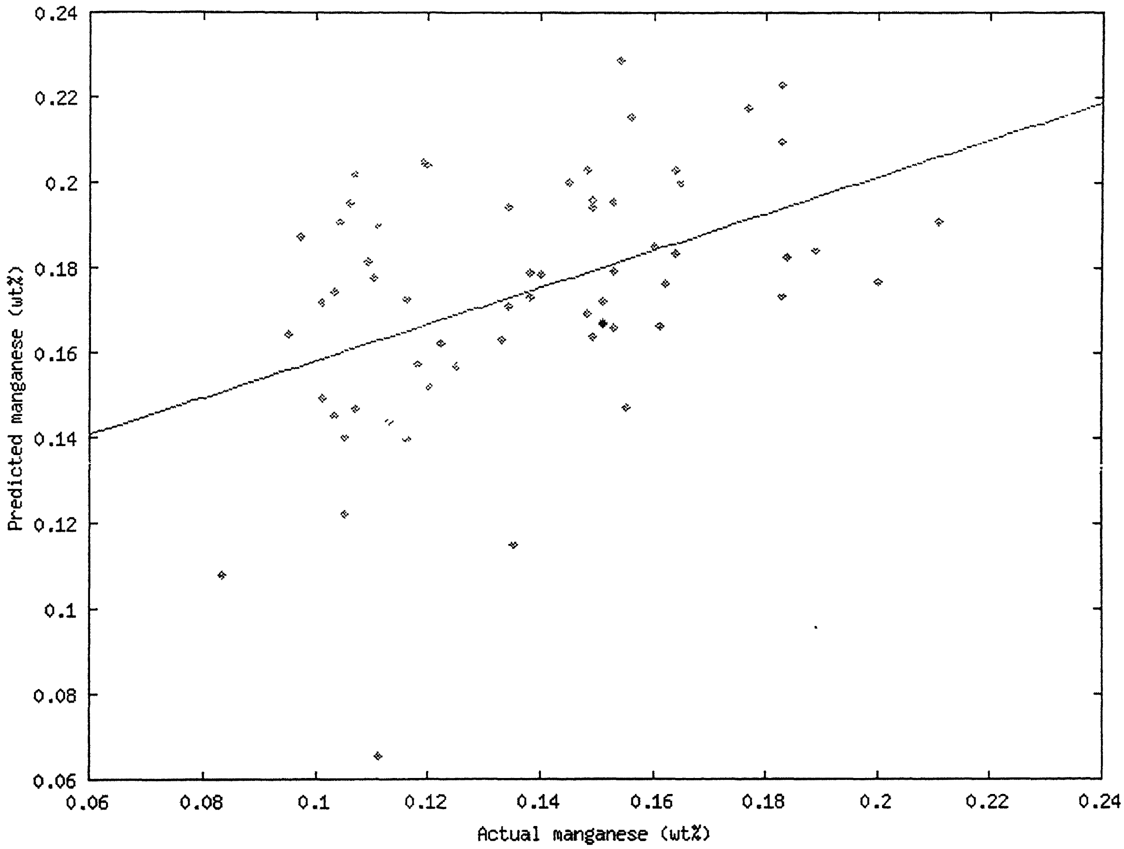

Fig 4.31 Predicted versus actual manganese for dataset D4 using sequential linear prediction equations

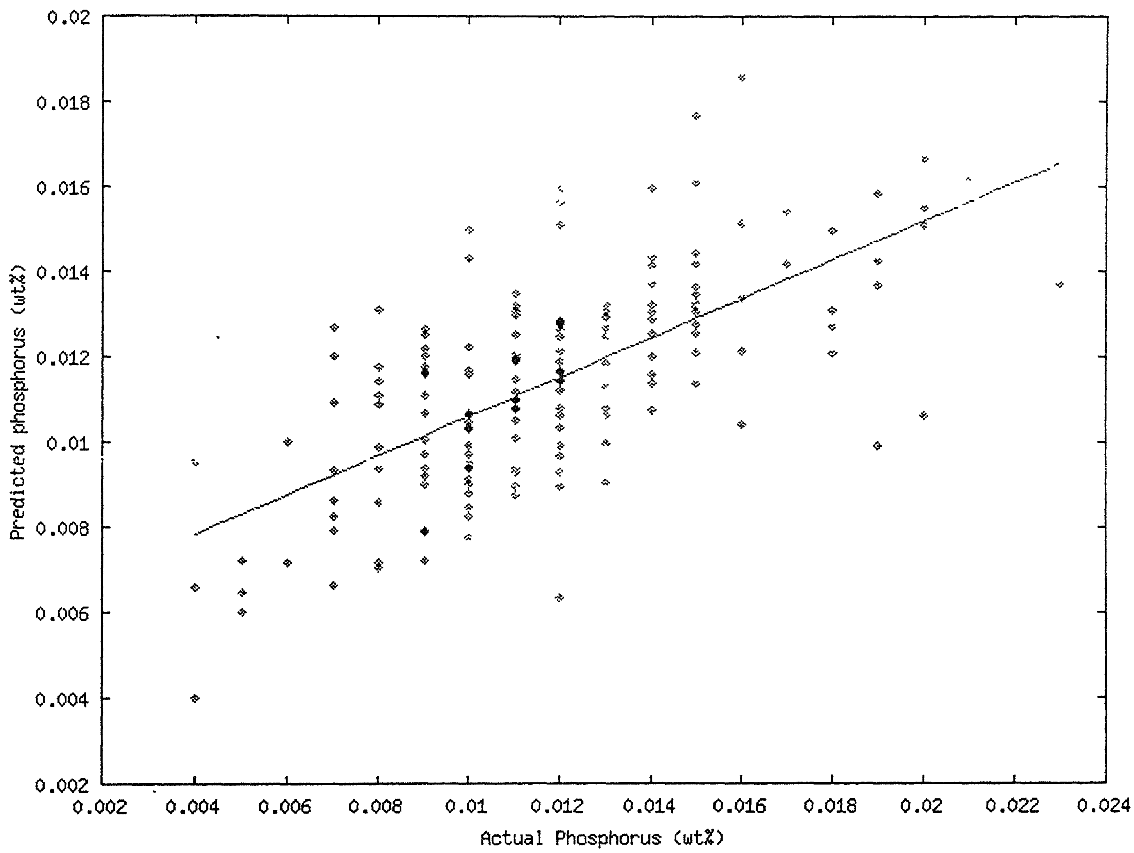

Fig 4.32 Predicted versus actual phosphorus for dataset D2 using sequential linear prediction equations

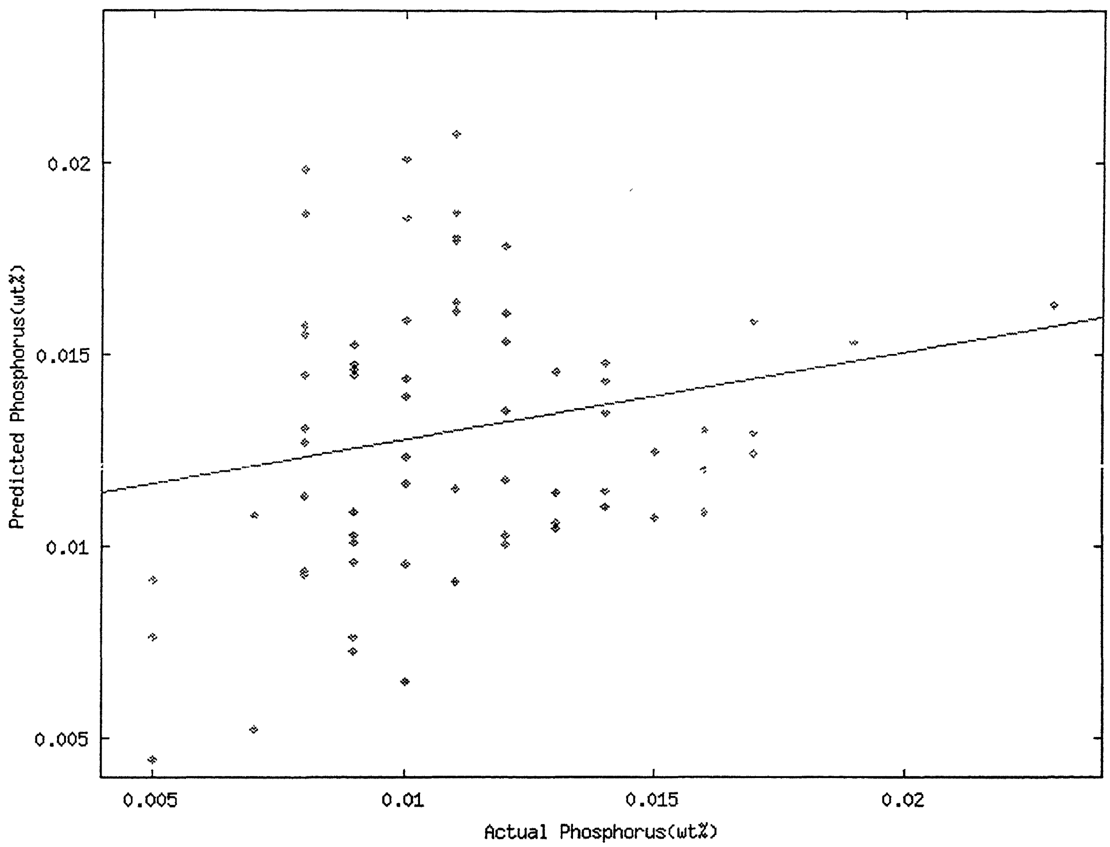

Fig 4.33 Predicted versus actual phosphorus for dataset D3 using sequential linear prediction equations

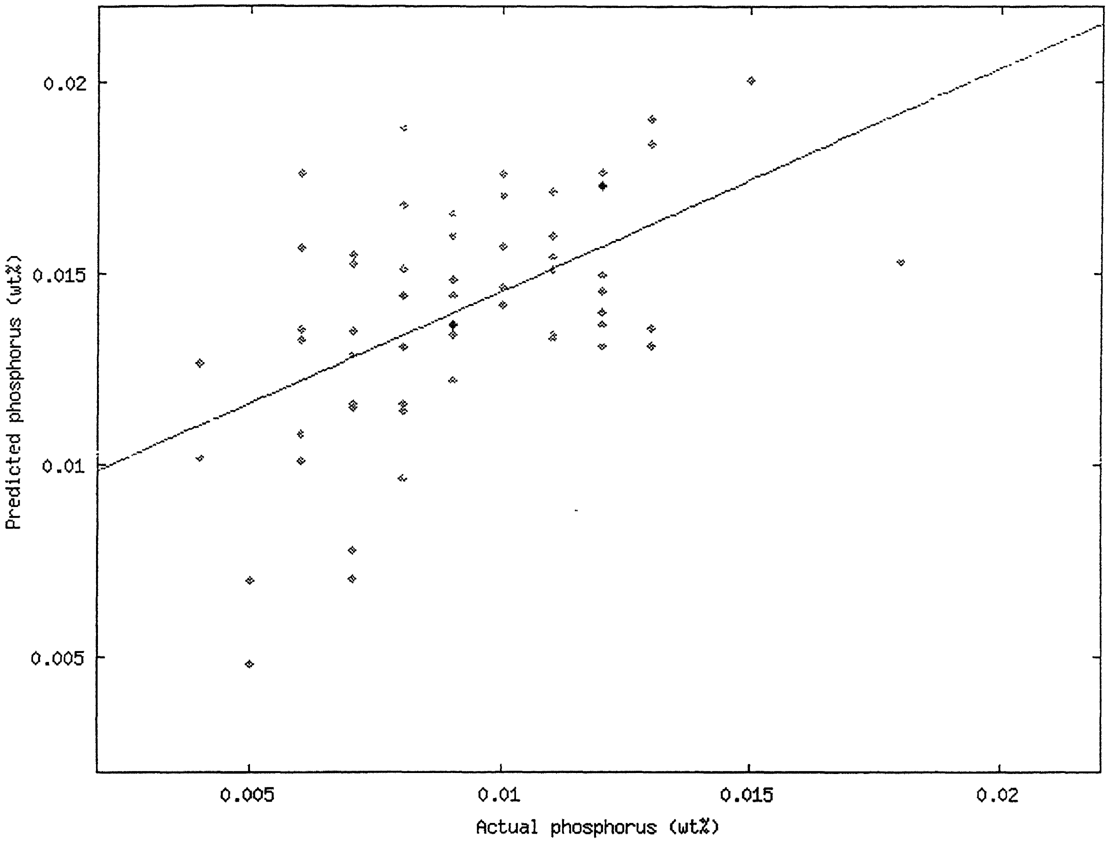

Fig 4.34 Predicted versus actual phosphorus for dataset D4 using sequential linear prediction equations

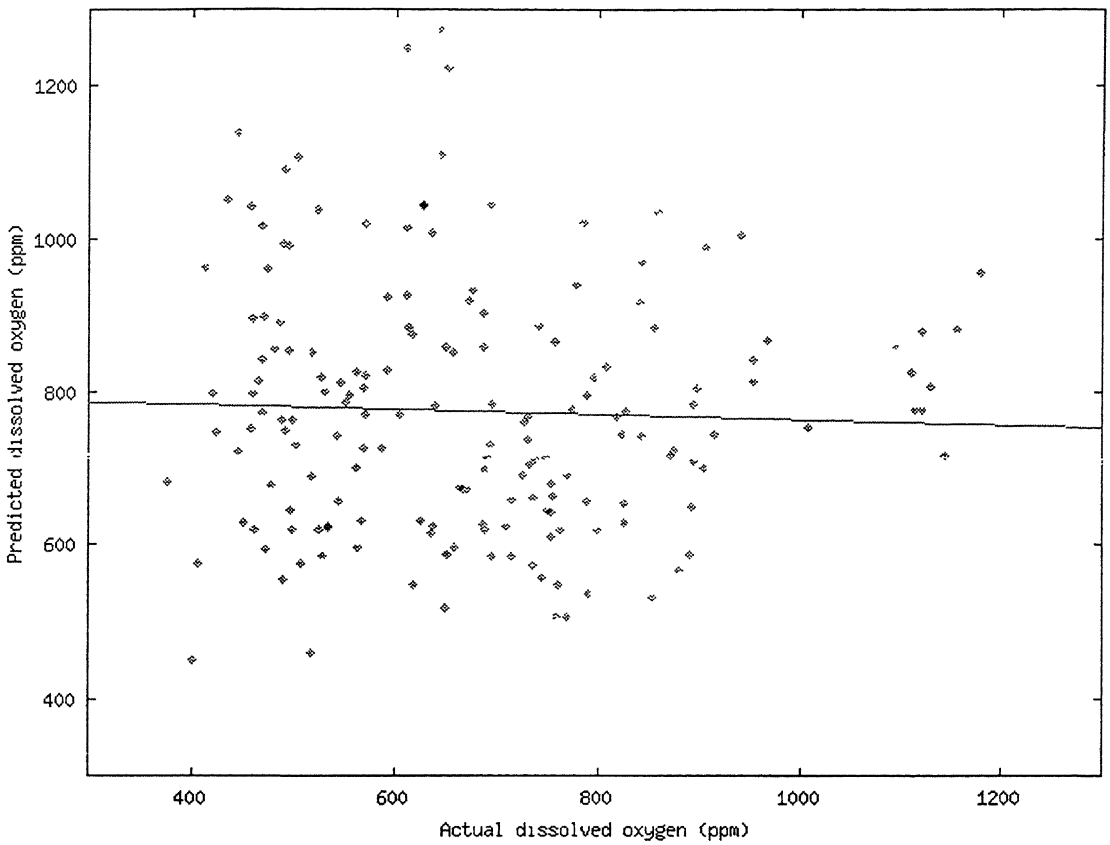

Fig 4.35 Predicted versus actual dissolved oxygen for dataset D2 using sequential linear prediction equations

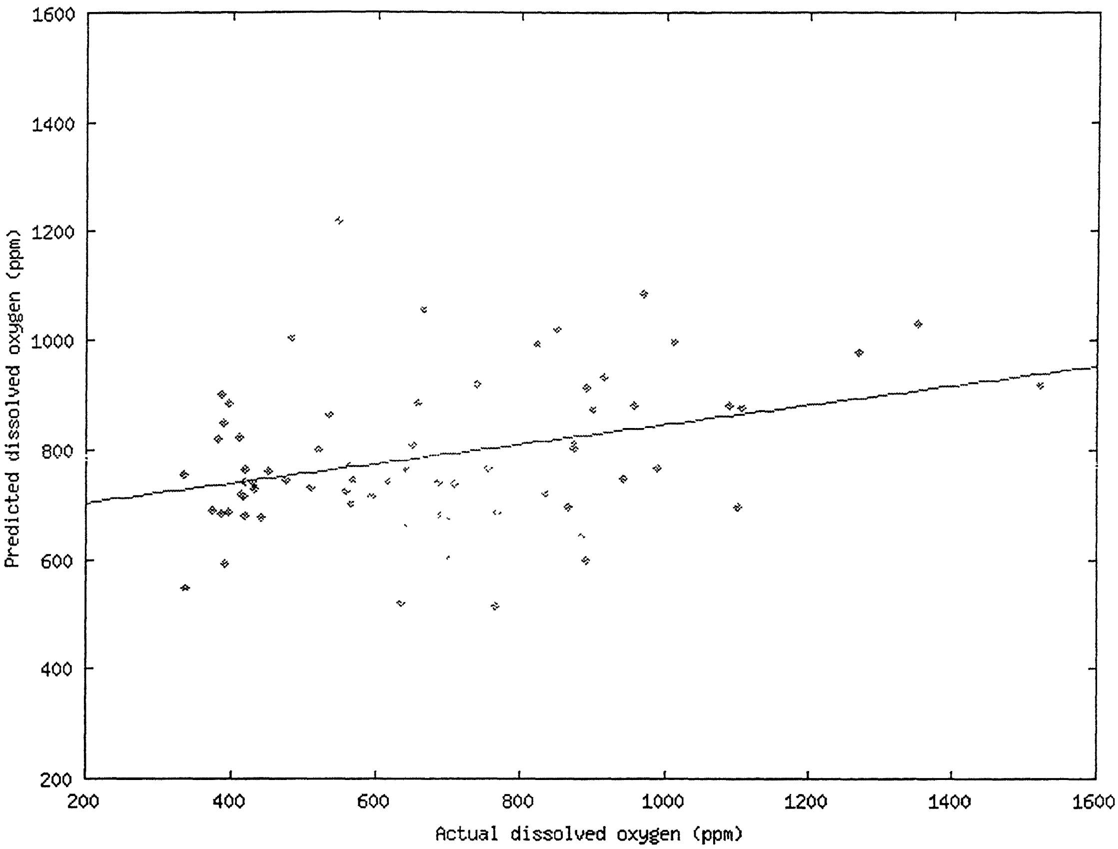

Fig 4.36 Predicted versus actual dissolved oxygen for dataset D3 using sequential linear prediction equations

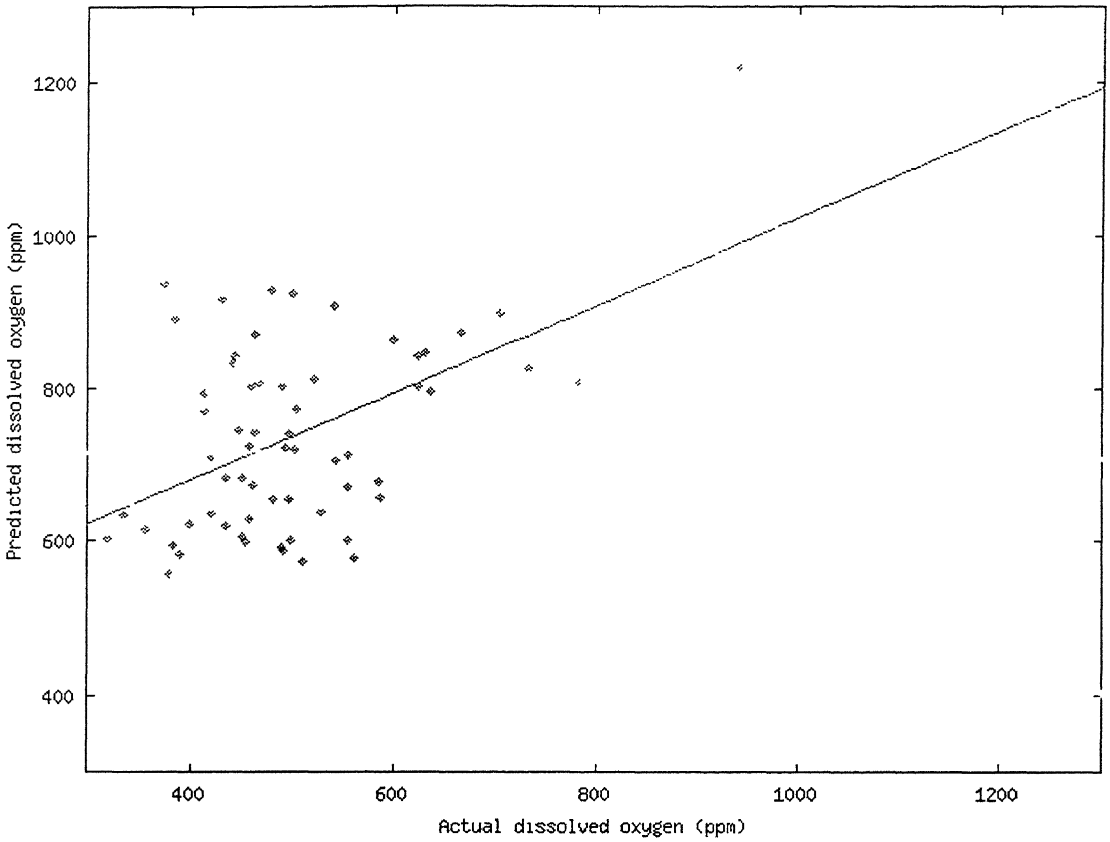

Fig 4.37 Predicted versus actual dissolved oxygen for dataset D4 using sequential linear prediction equations

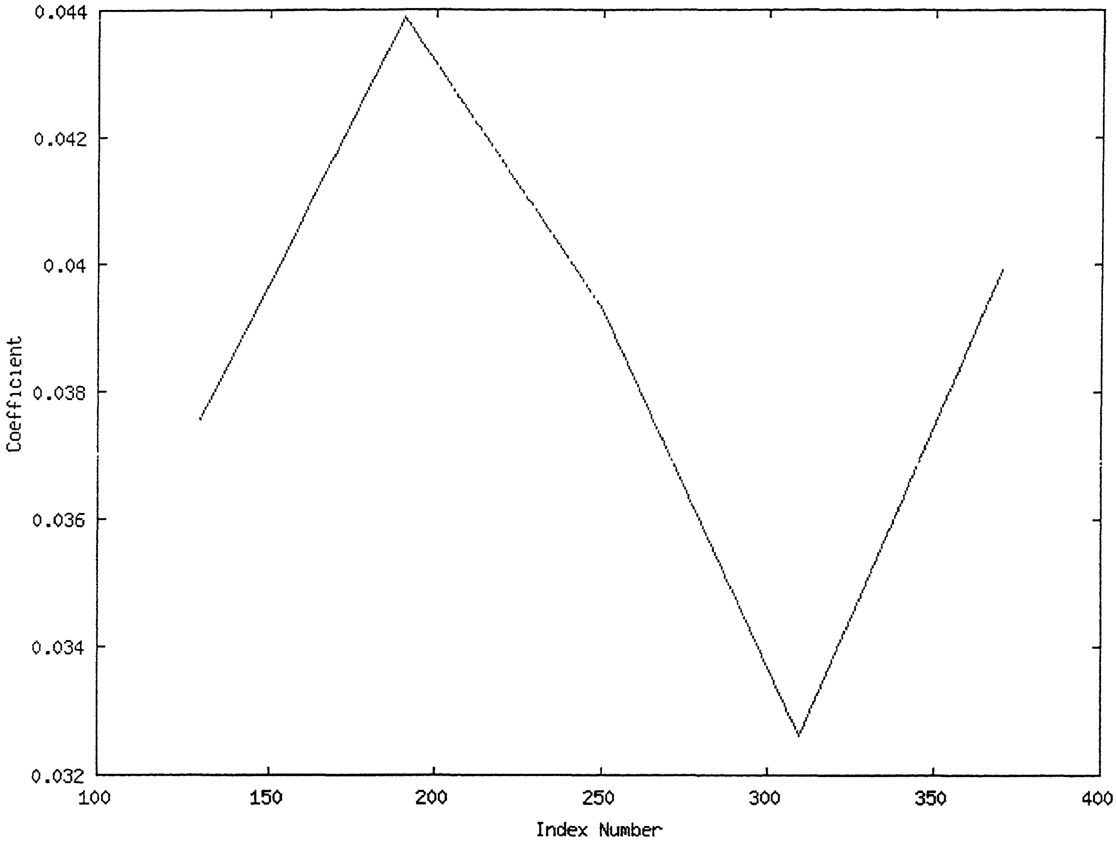

Fig 4.38 Variation of coefficient of C1 in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

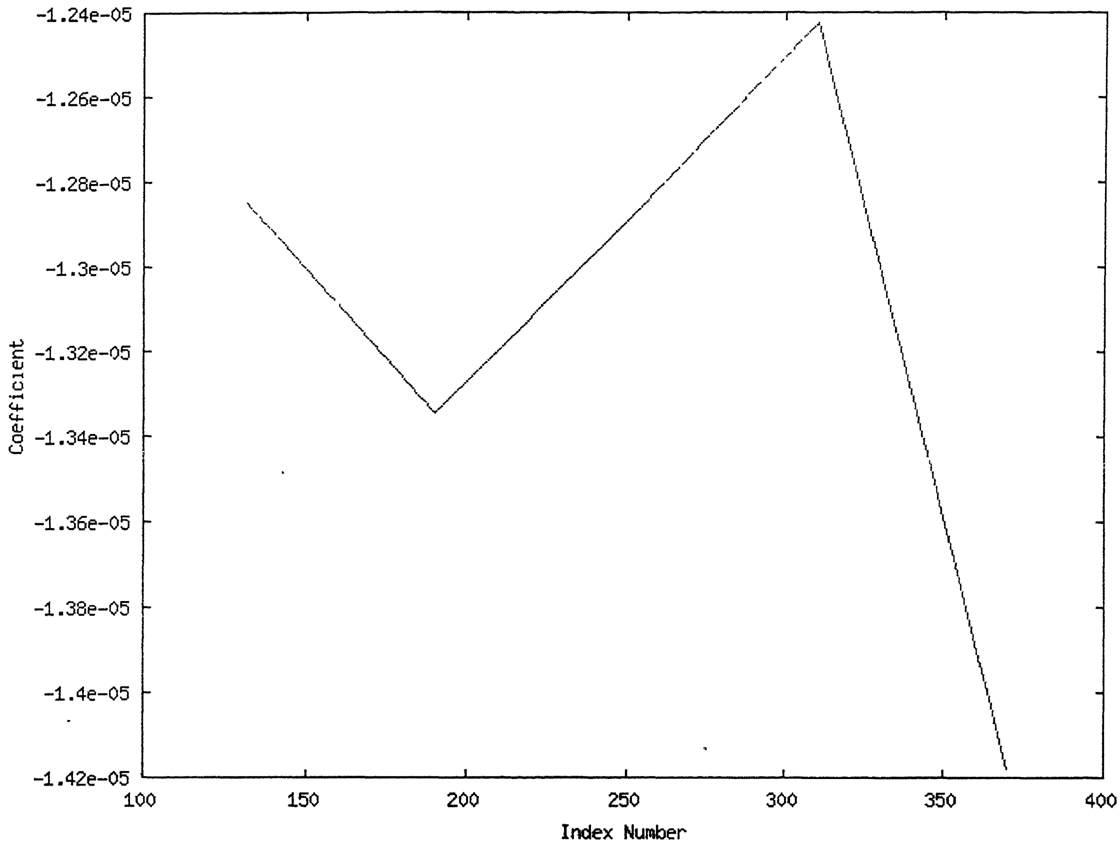

Fig 4.39 Variation of coefficient of O22 in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

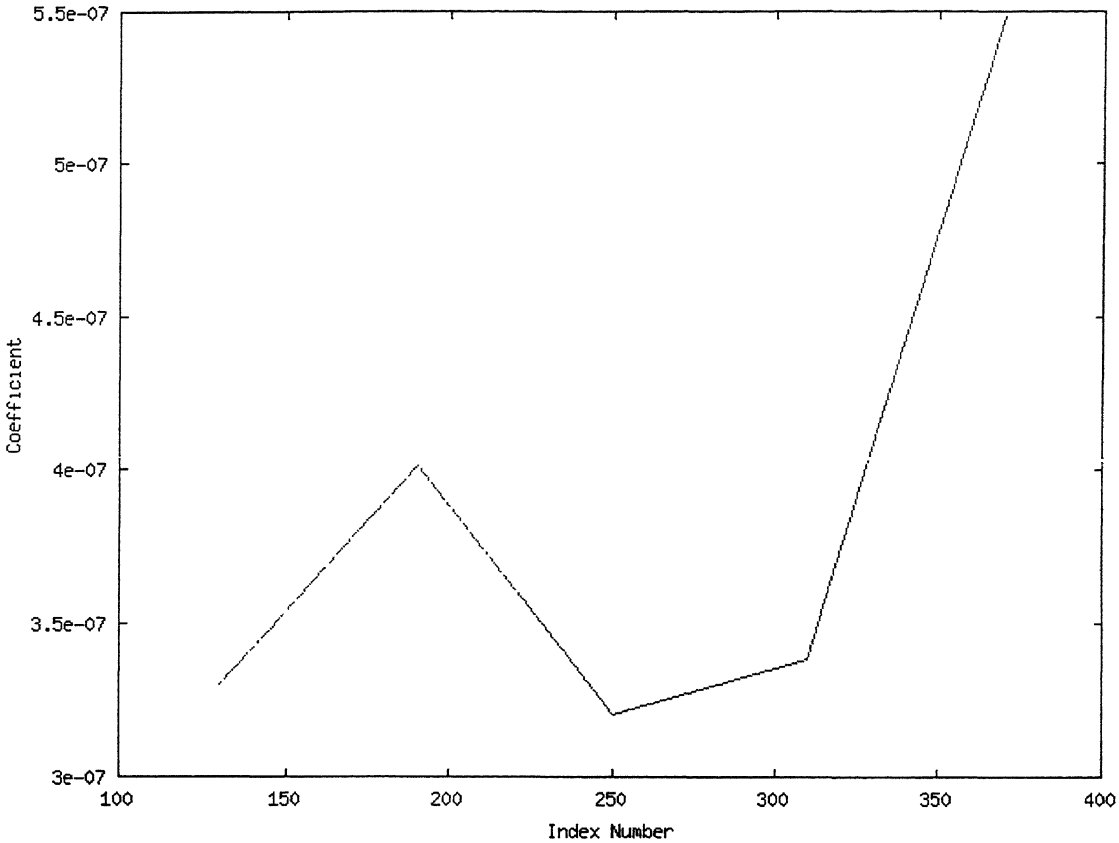

Fig 4.40 Variation of coefficient of SVOL in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

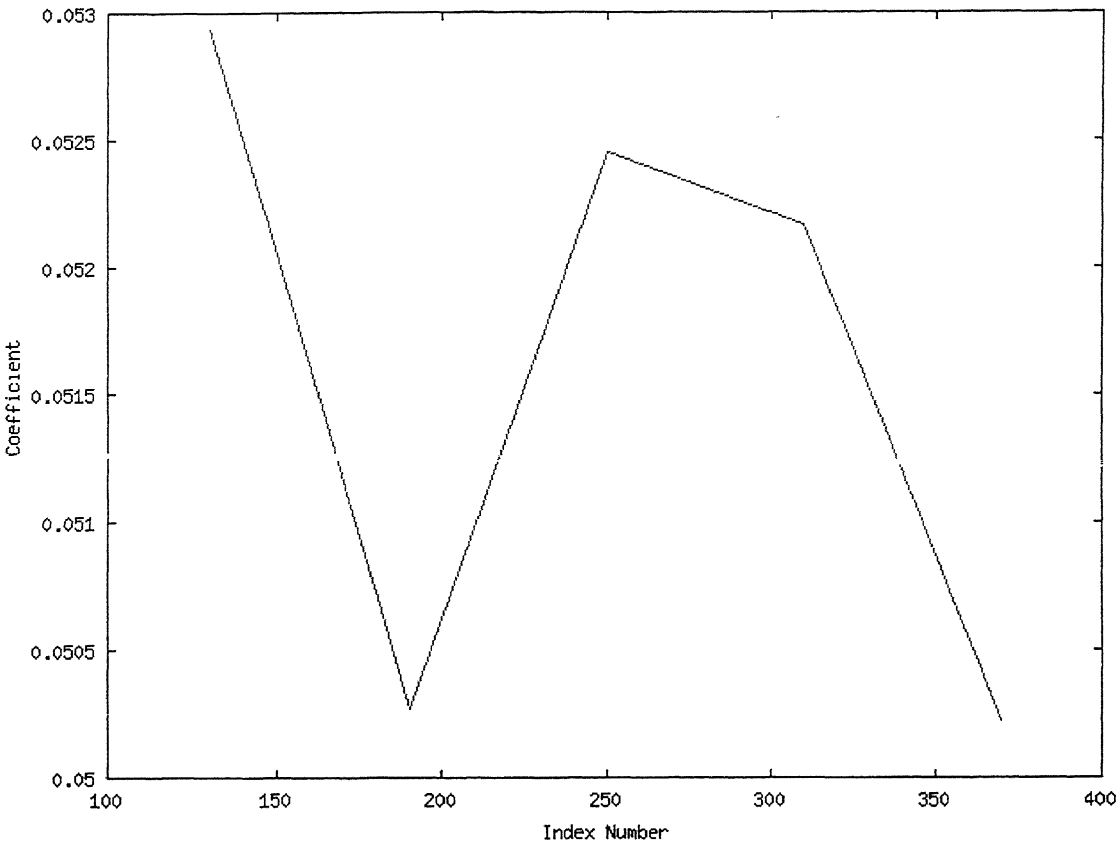

Fig 4.41 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

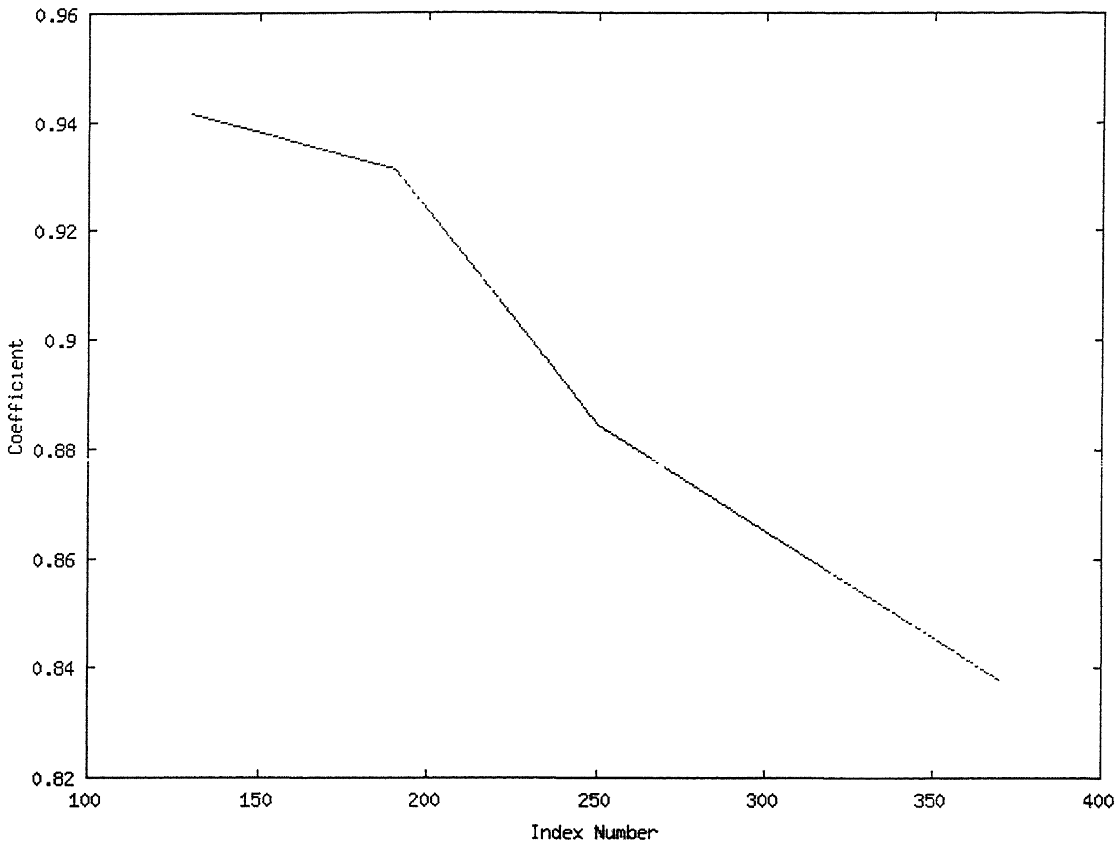

Fig 4.42 Variation of coefficient of T1 in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

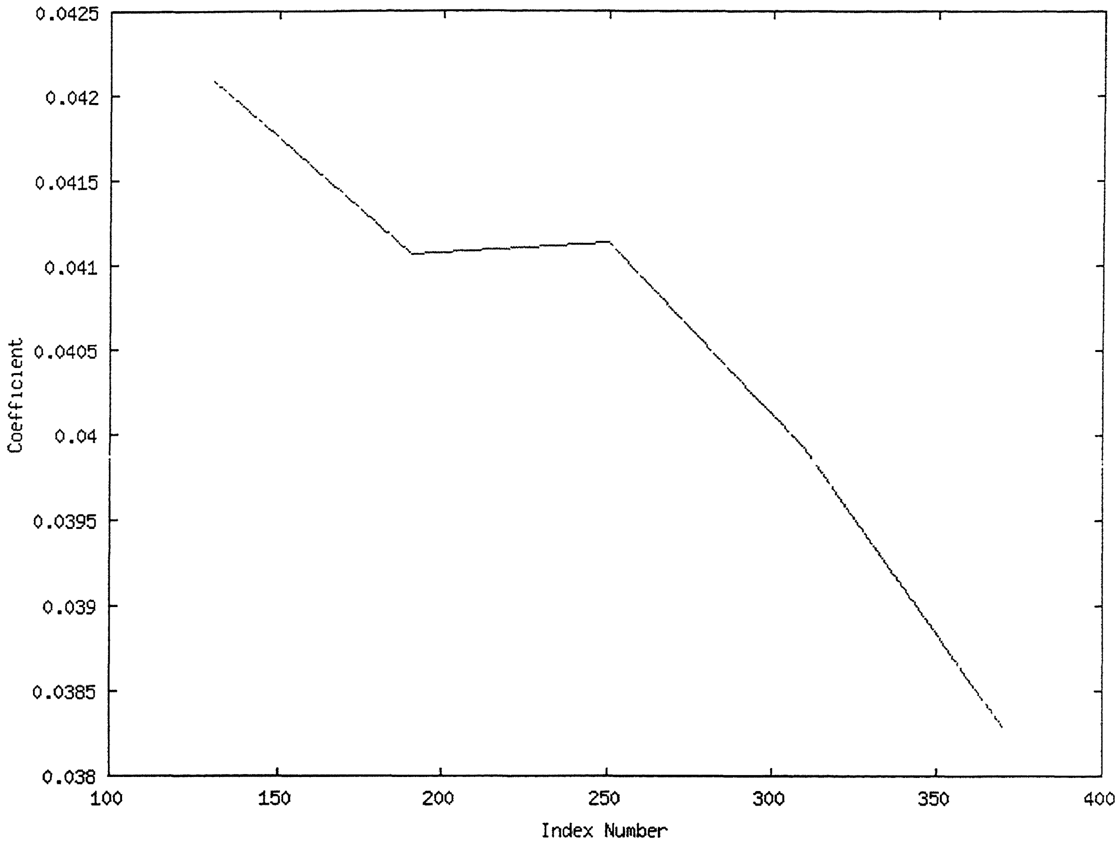

Fig 4.43 Variation of coefficient of O22 in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

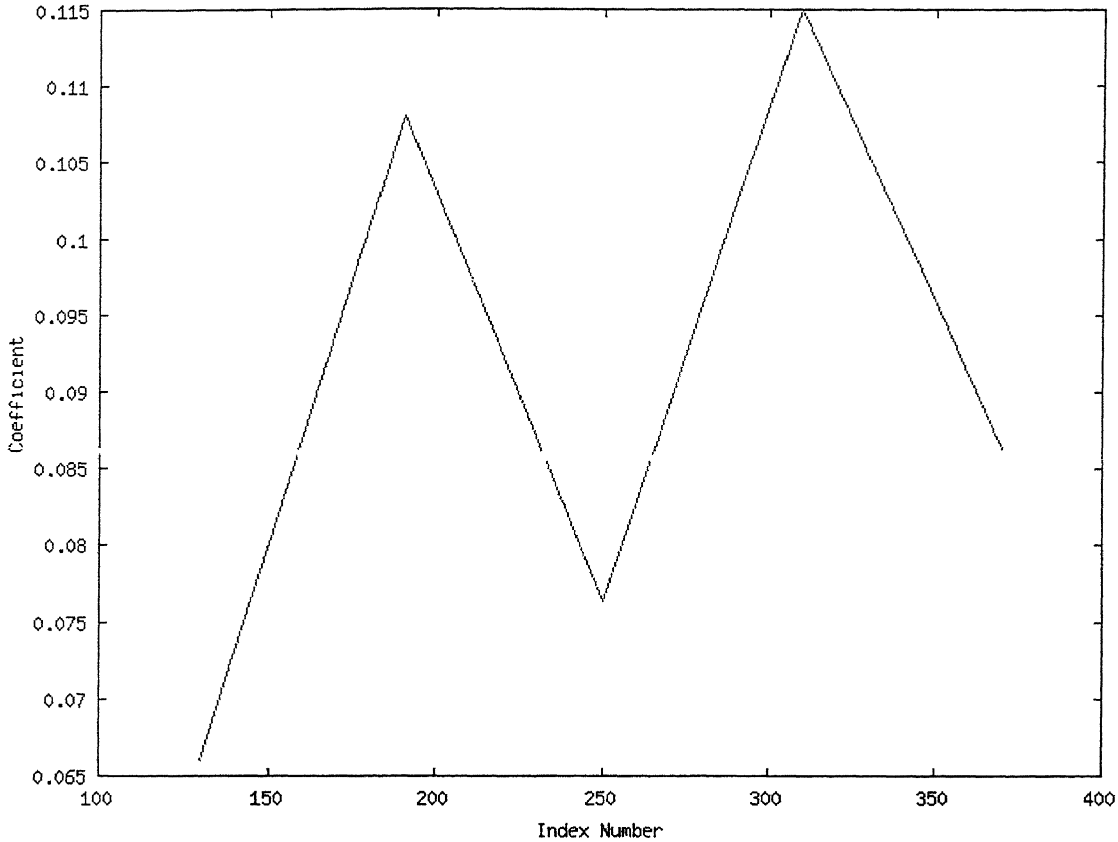

Fig 4.44 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

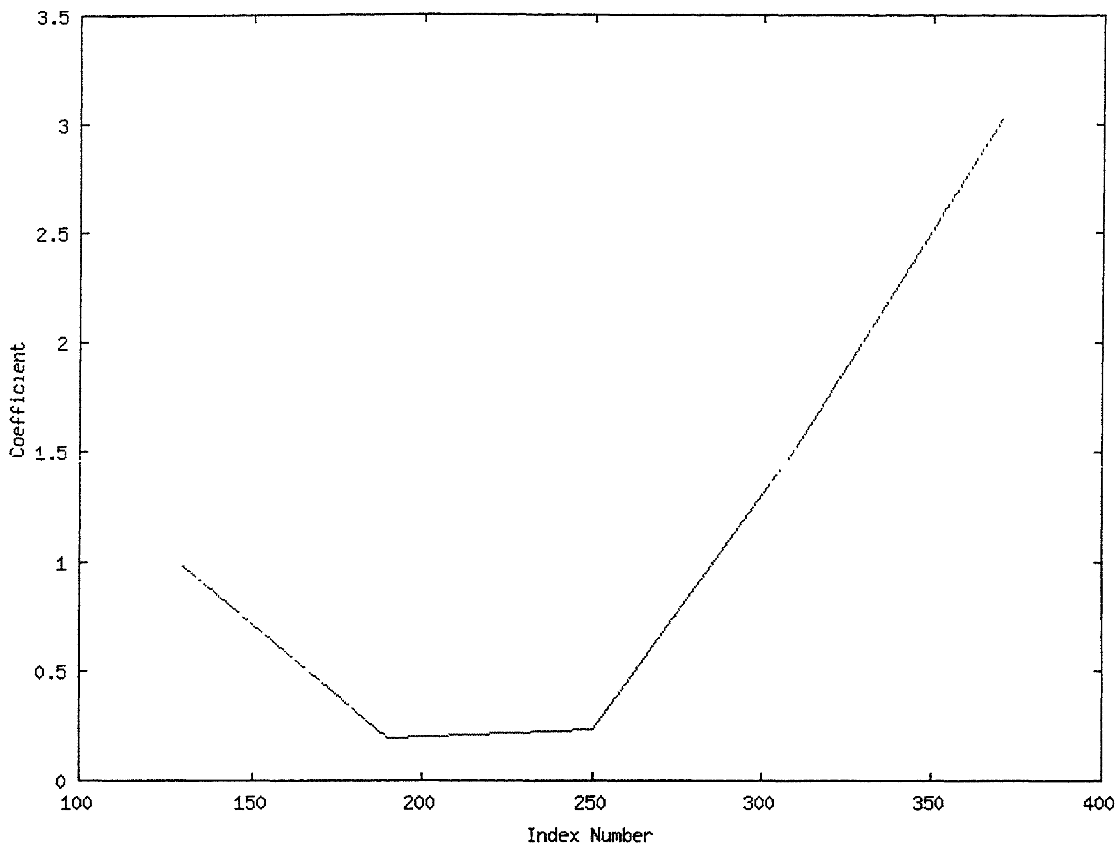

Fig 4.45 Variation of coefficient of HTR in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

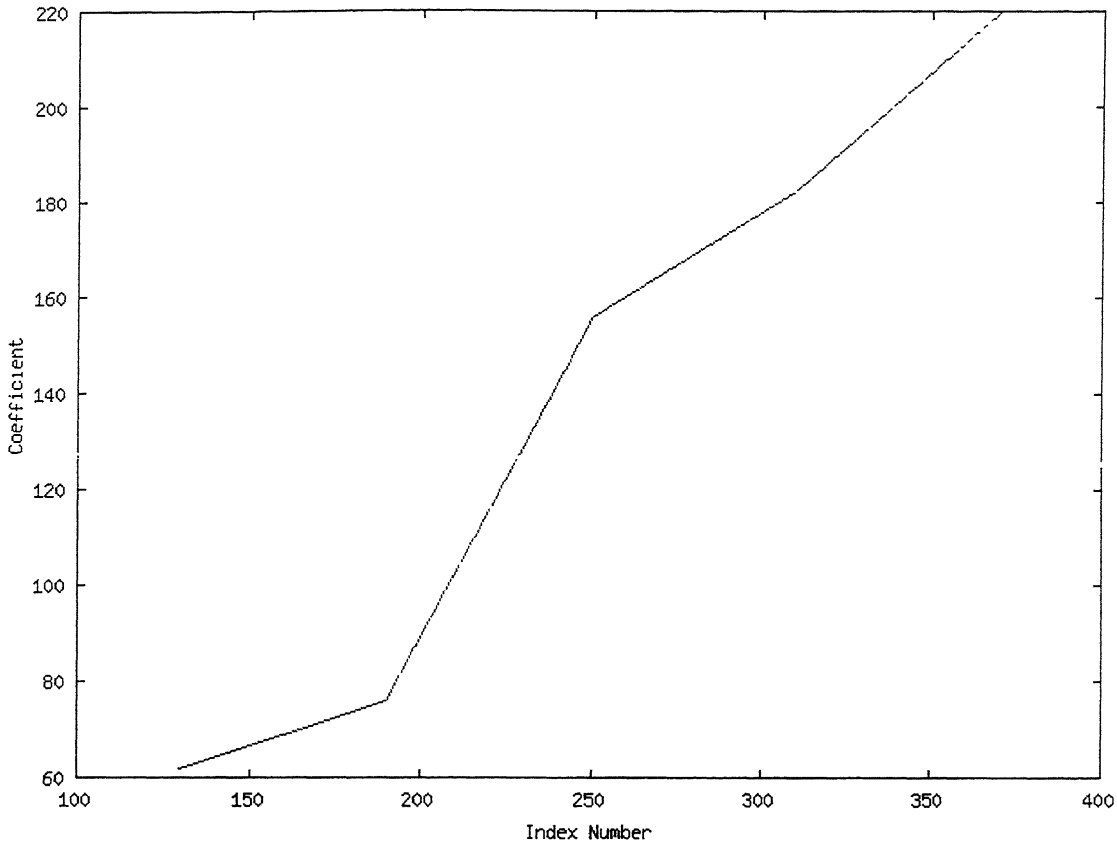

Fig 4.46 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for T2 (For group 1 in which no RDOLO2 and ORE2 is added)

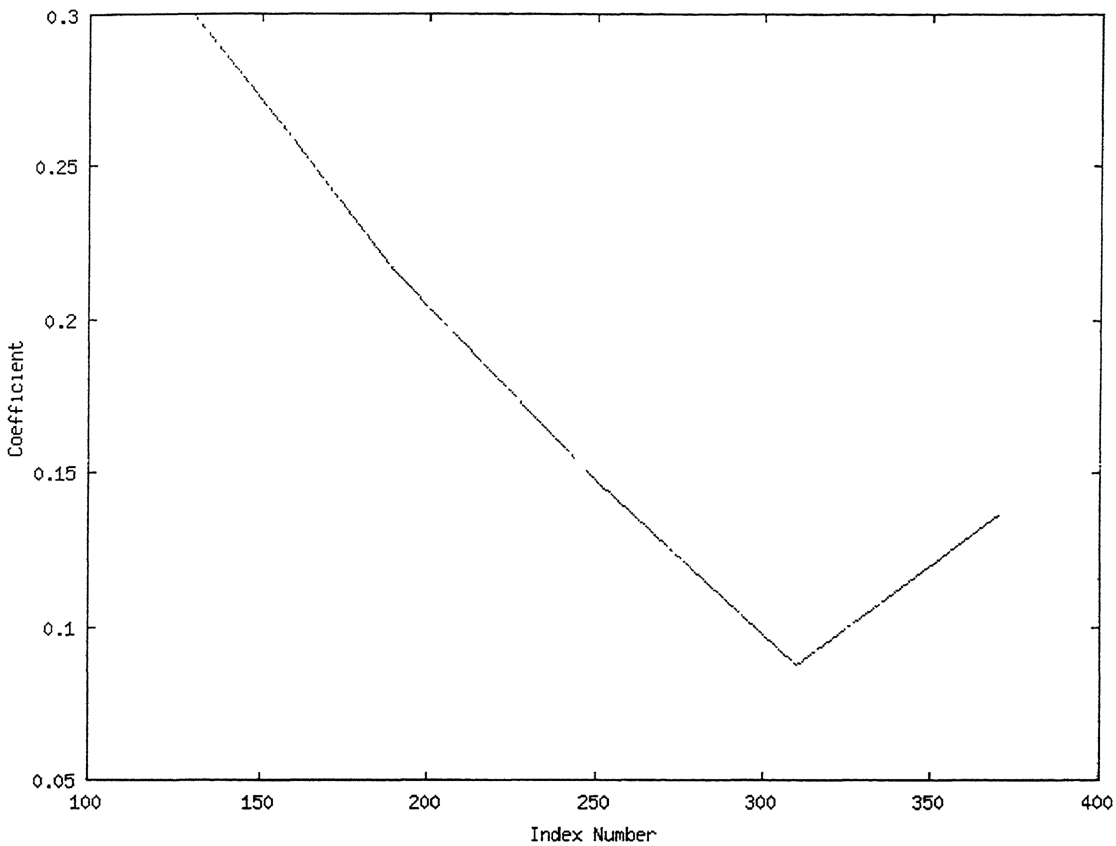

Fig 4.47 Variation of coefficient of Mn0 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

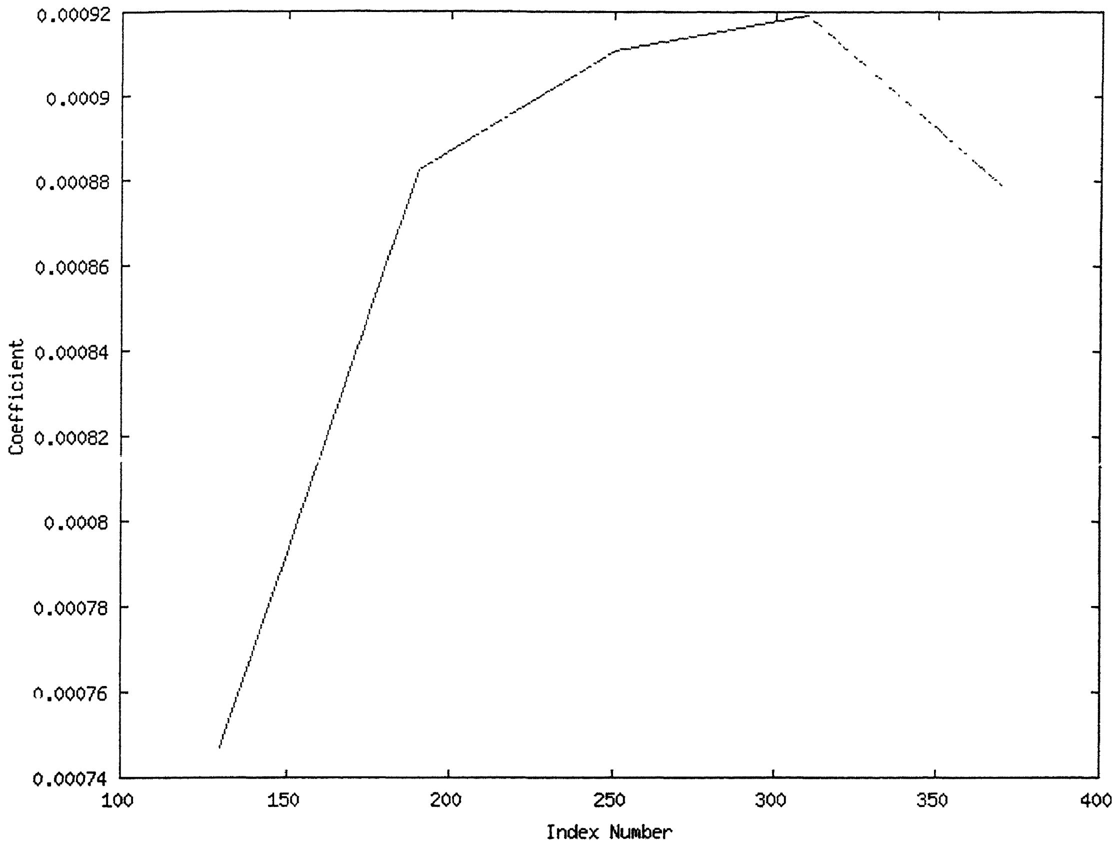

Fig 4.48 Variation of coefficient of T1 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

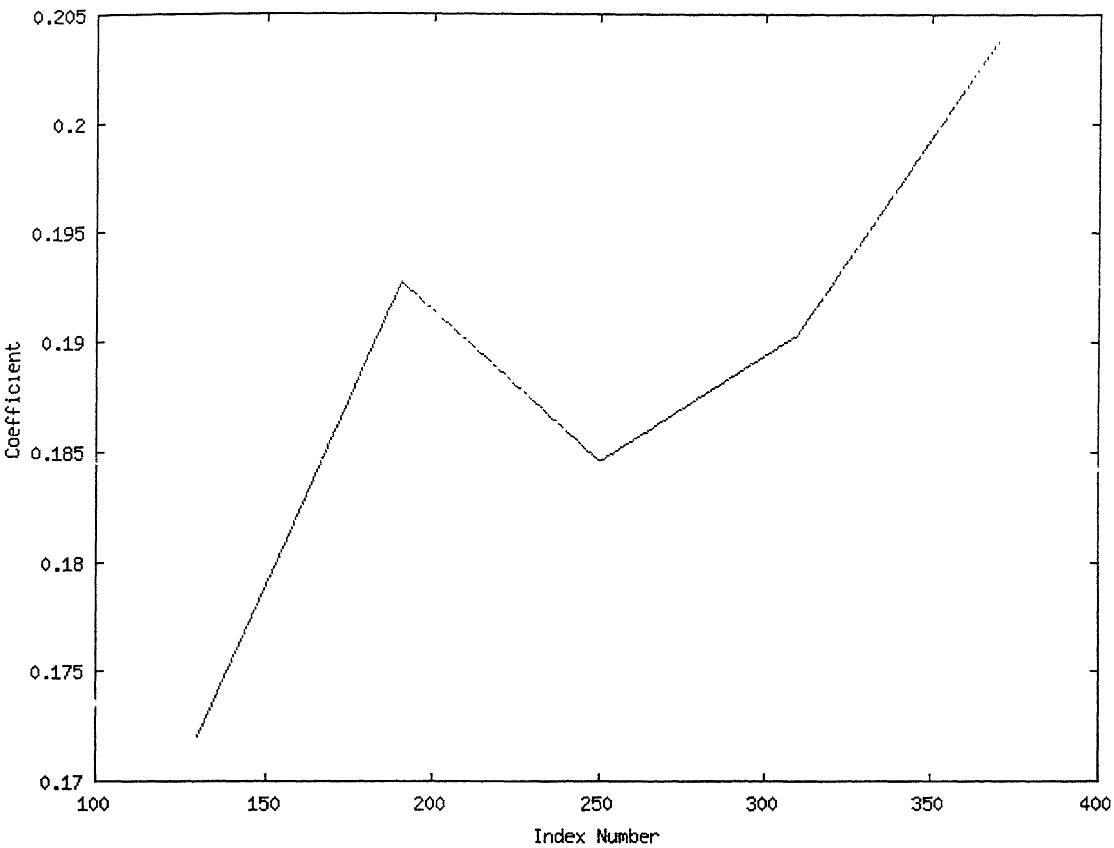

Fig 4.49 Variation of coefficient of C1 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

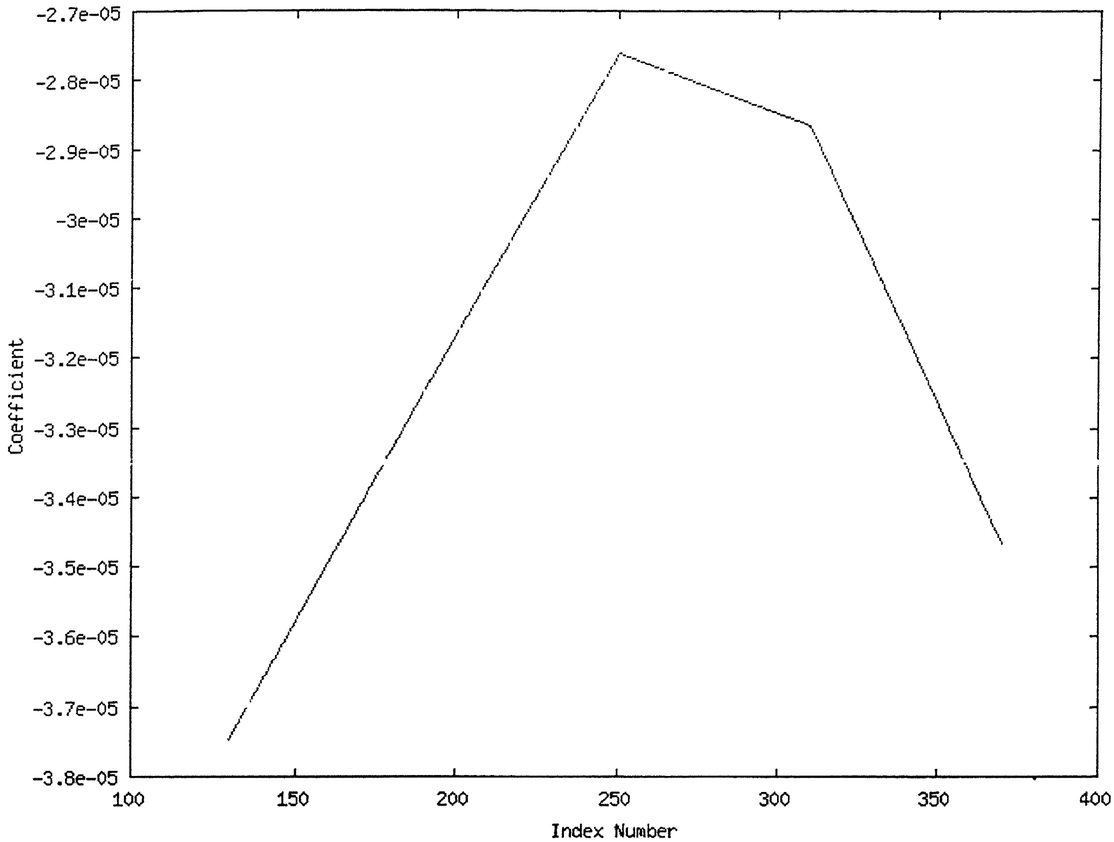

Fig 4.50 Variation of coefficient of O22 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

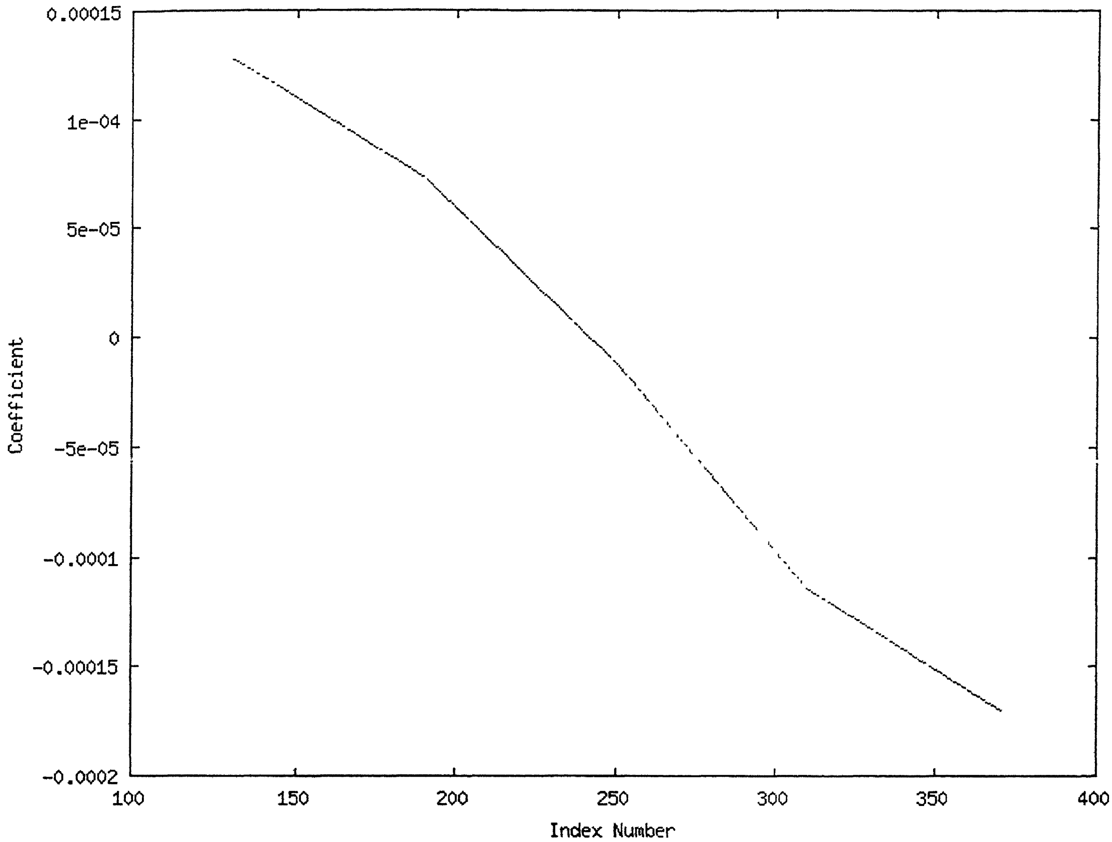

Fig 4.51 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

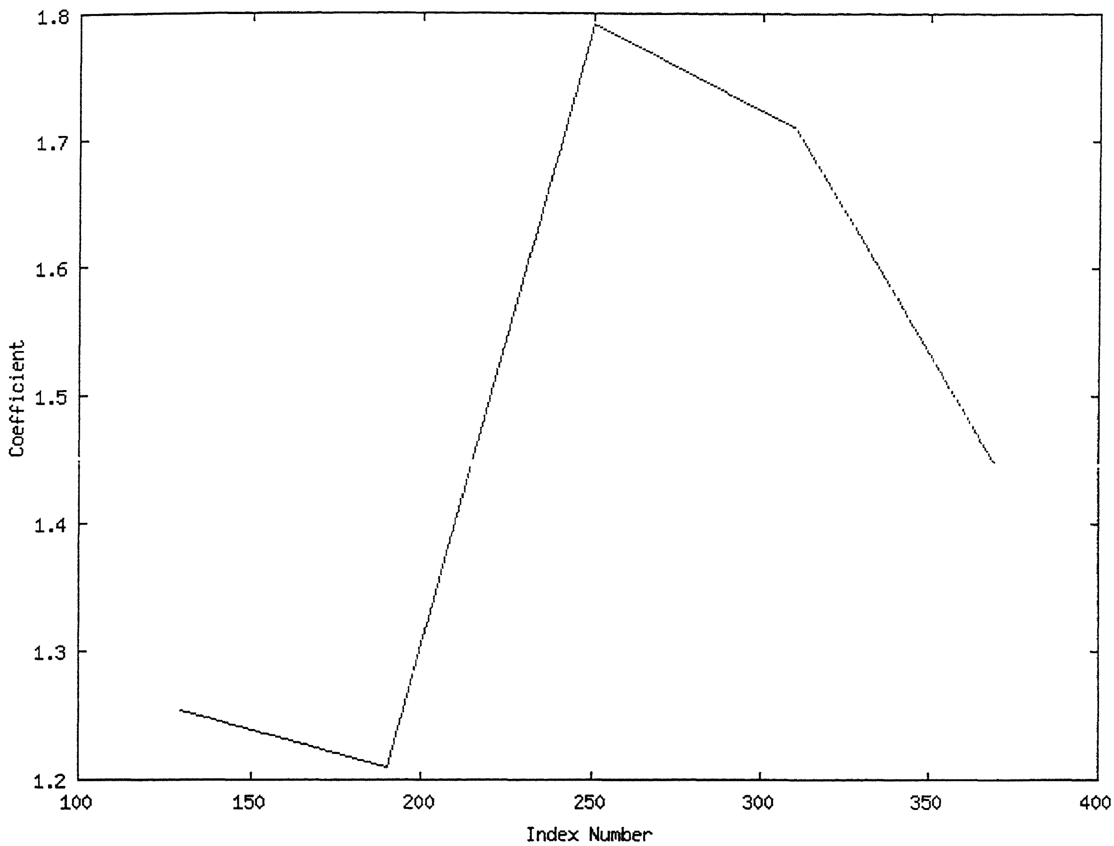

Fig 4.52 Variation of coefficient of C2 in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

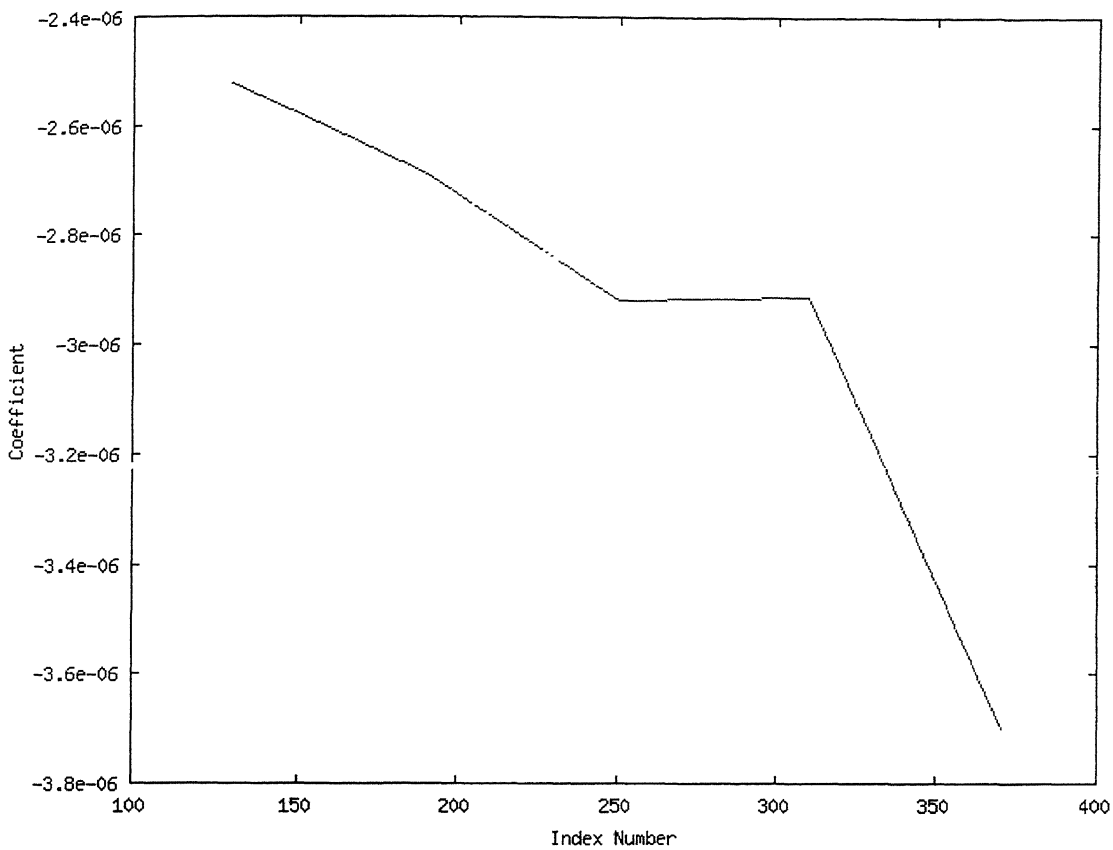

Fig 4.53 Variation of coefficient of SVOL in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

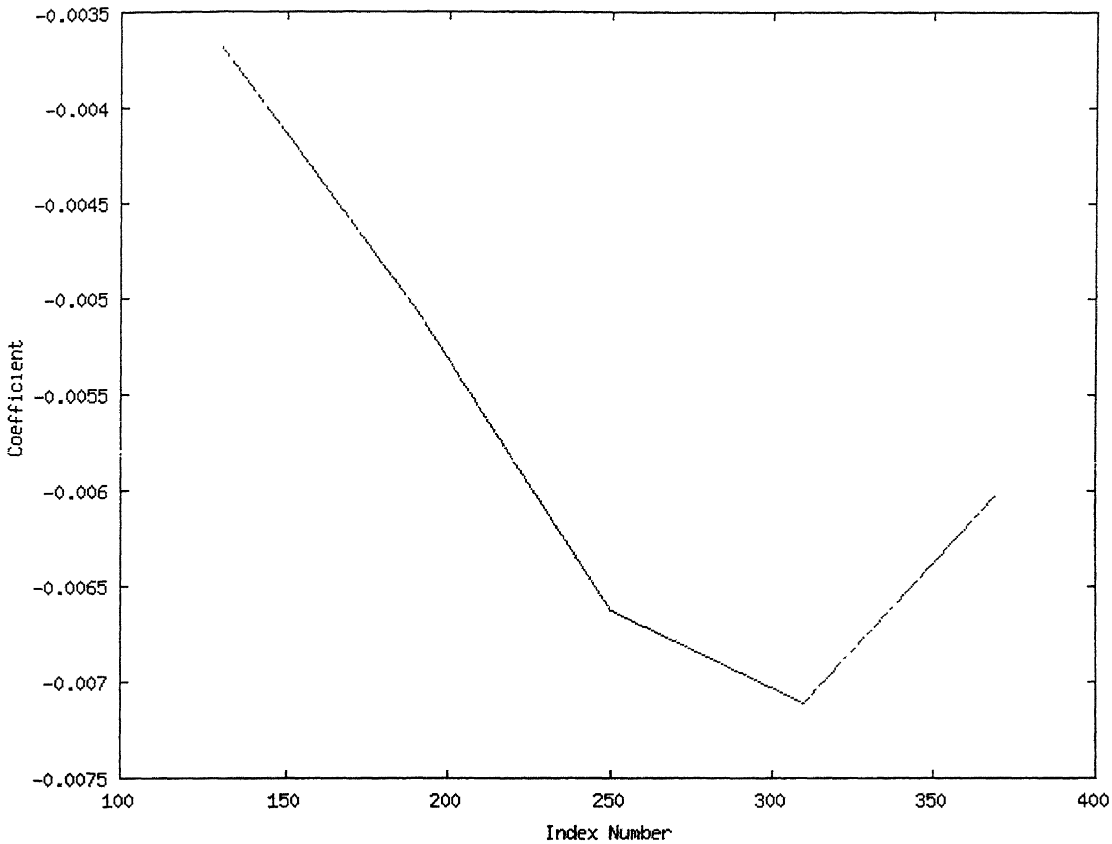

Fig 4.54 Variation of coefficient of HTR in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

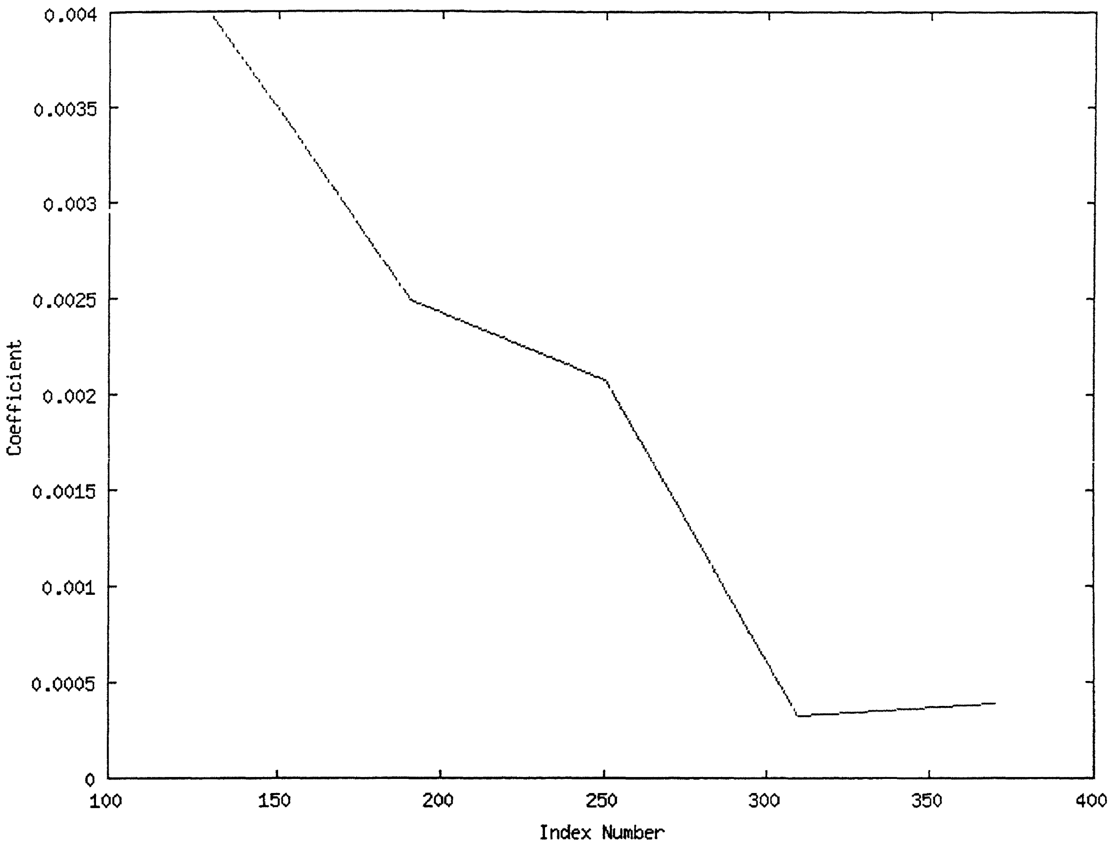

Fig 4.55 Variation of coefficient of BAS in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

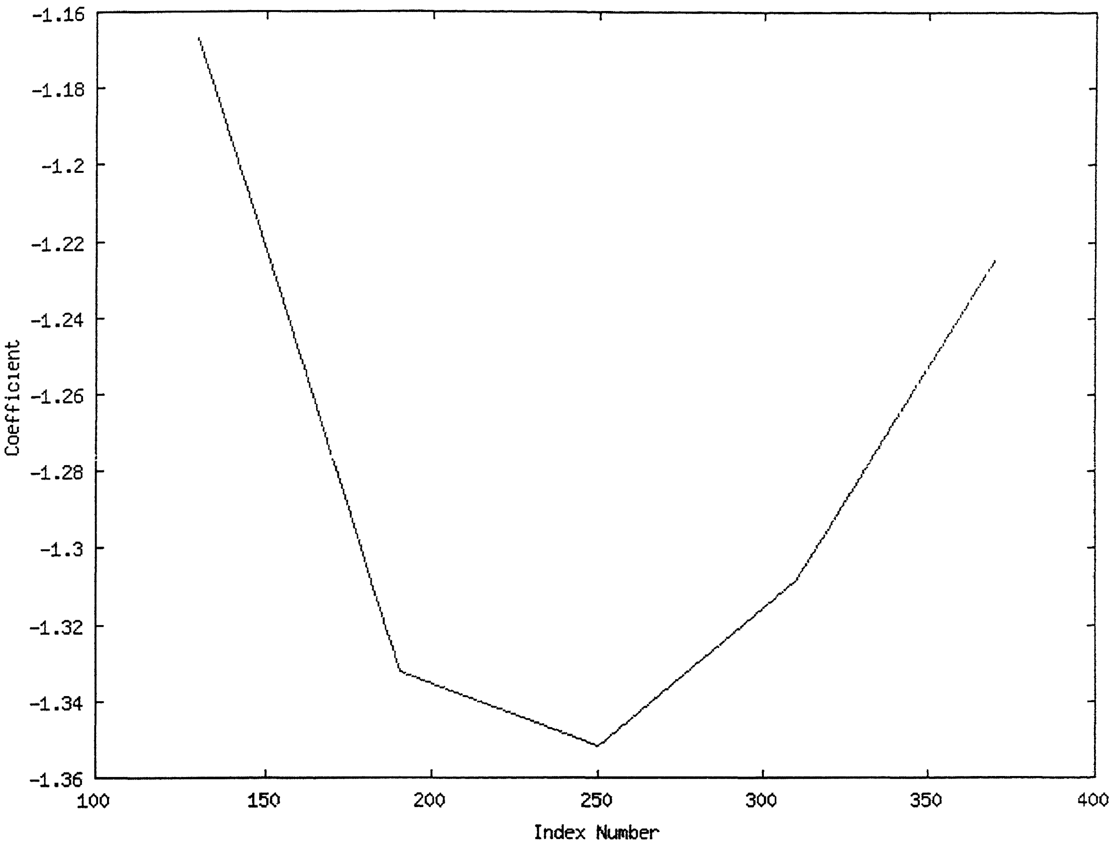

Fig 4.56 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for Mn2 (For group 1 in which no RDOLO2 and ORE2 is added)

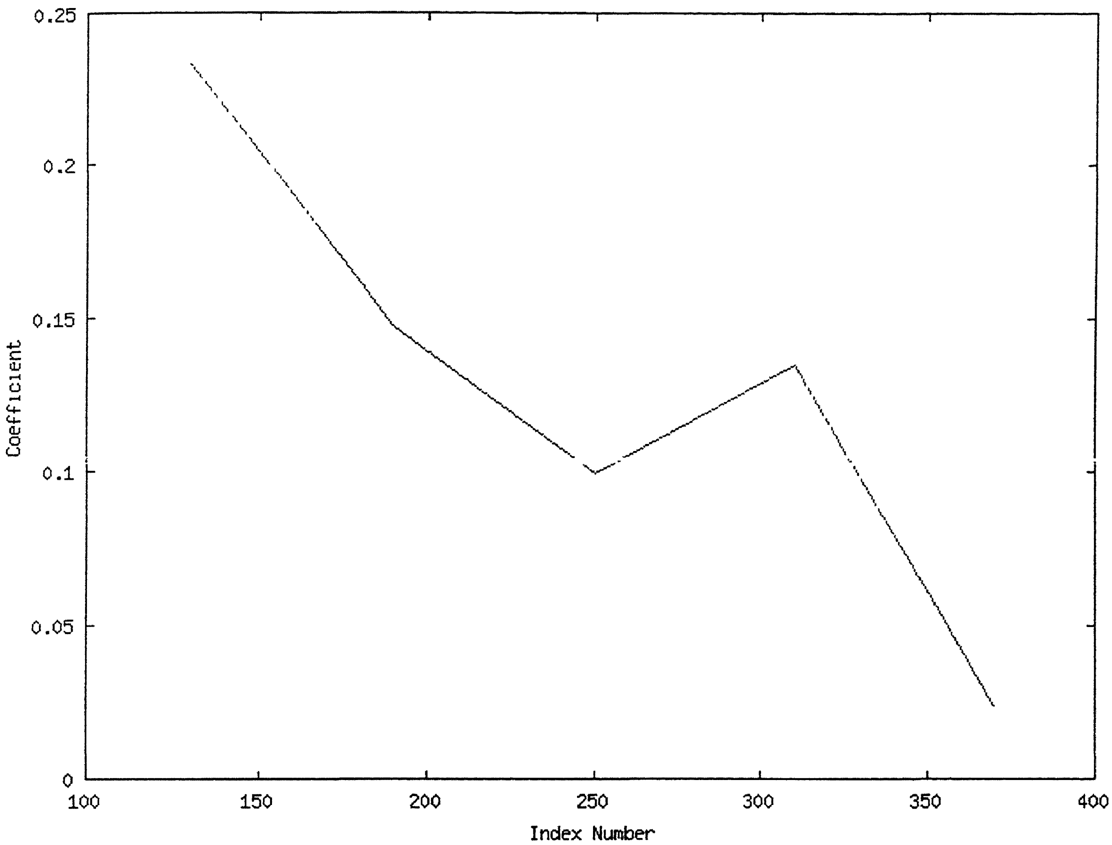

Fig 4.57 Variation of coefficient of P0 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

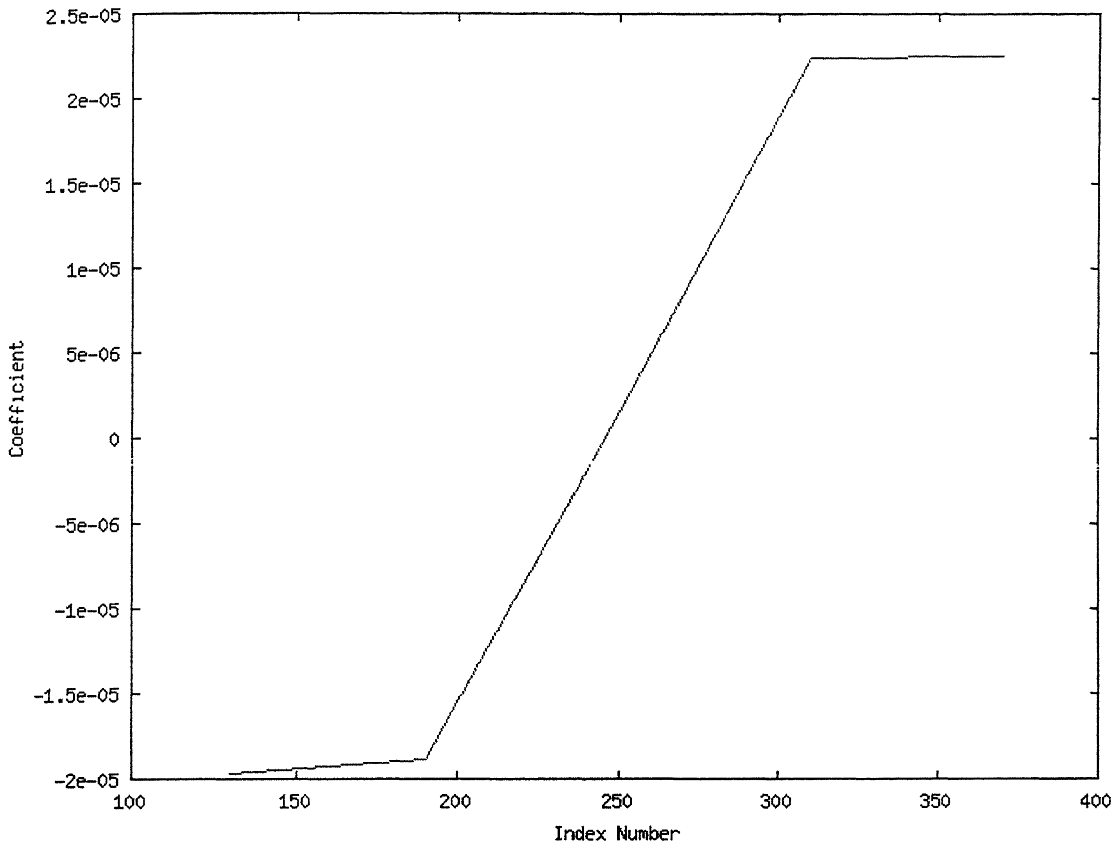

Fig 4.58 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

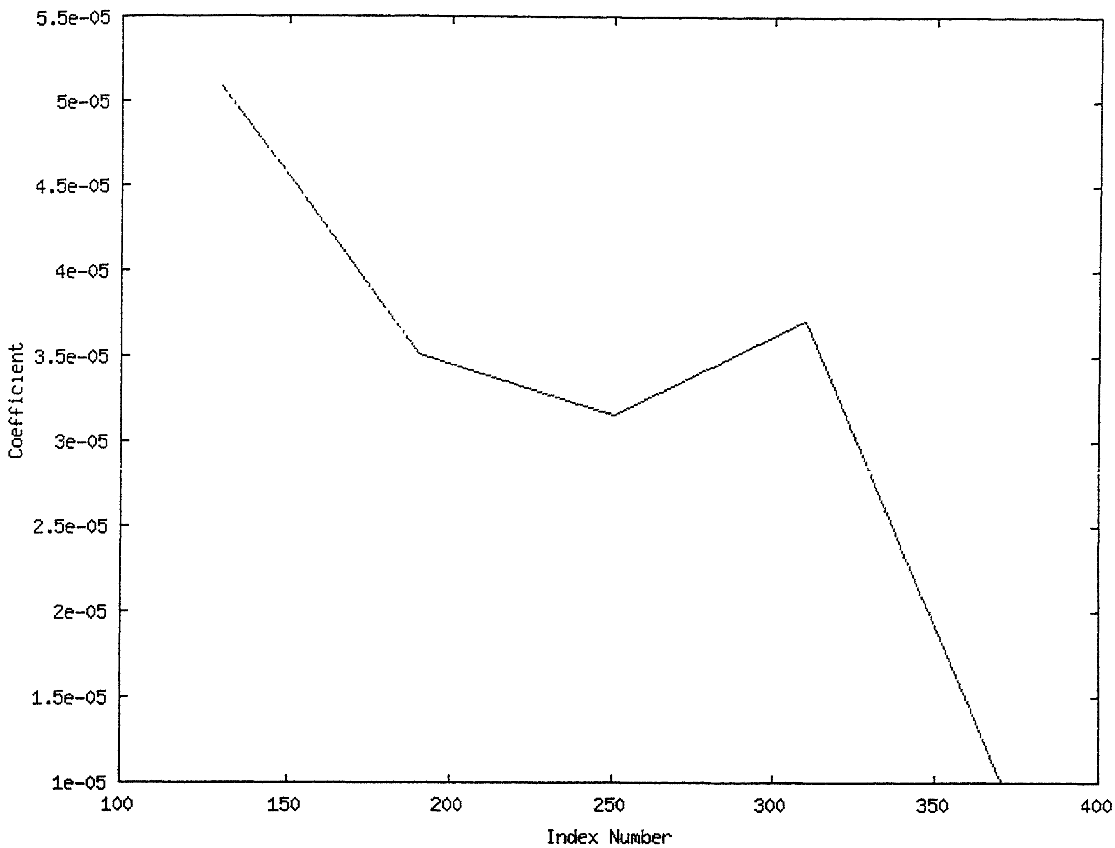

Fig 4.59 Variation of coefficient of T2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

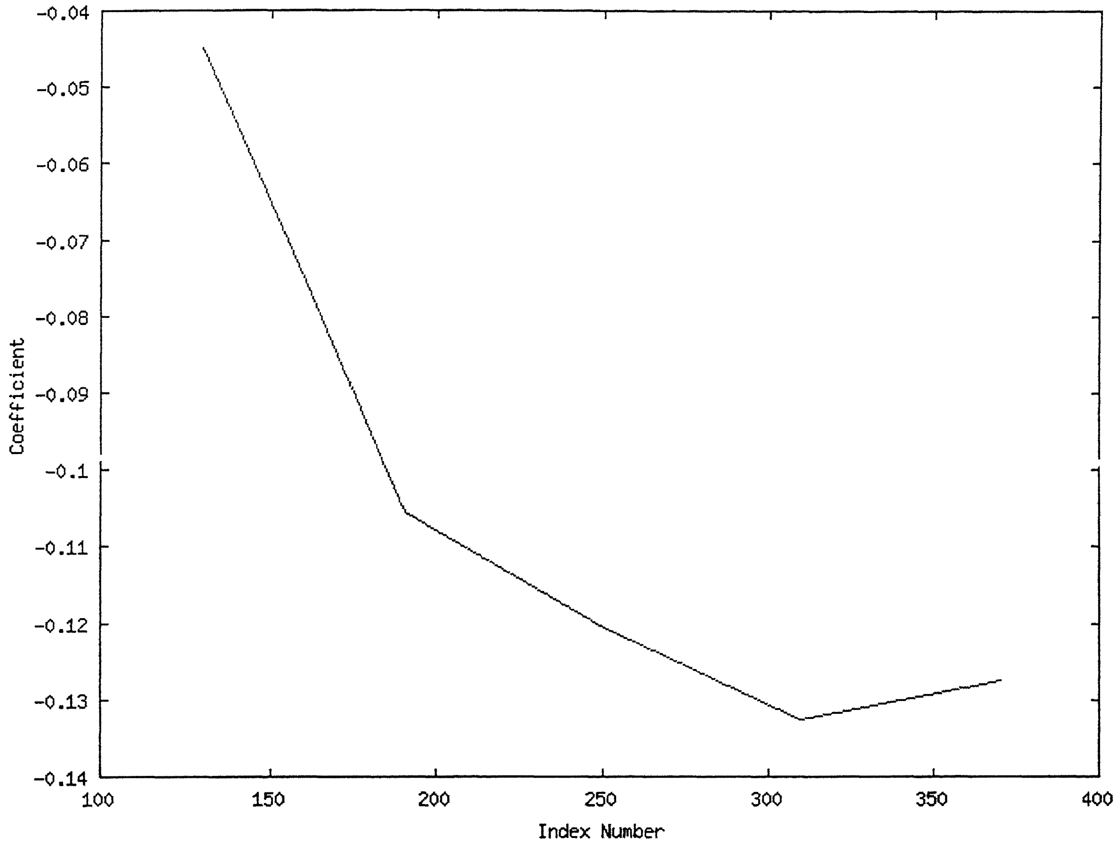

Fig 4.60 Variation of coefficient of C2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

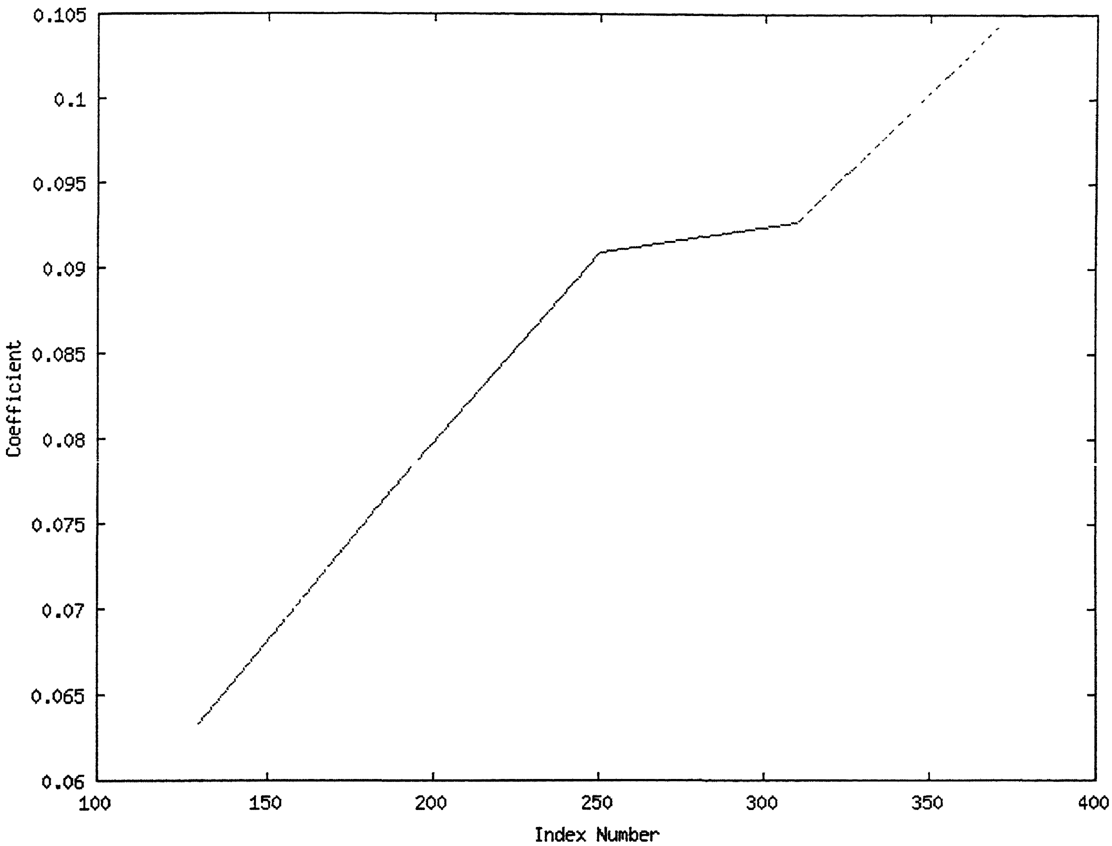

Fig 4.61 Variation of coefficient of Mn2 in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

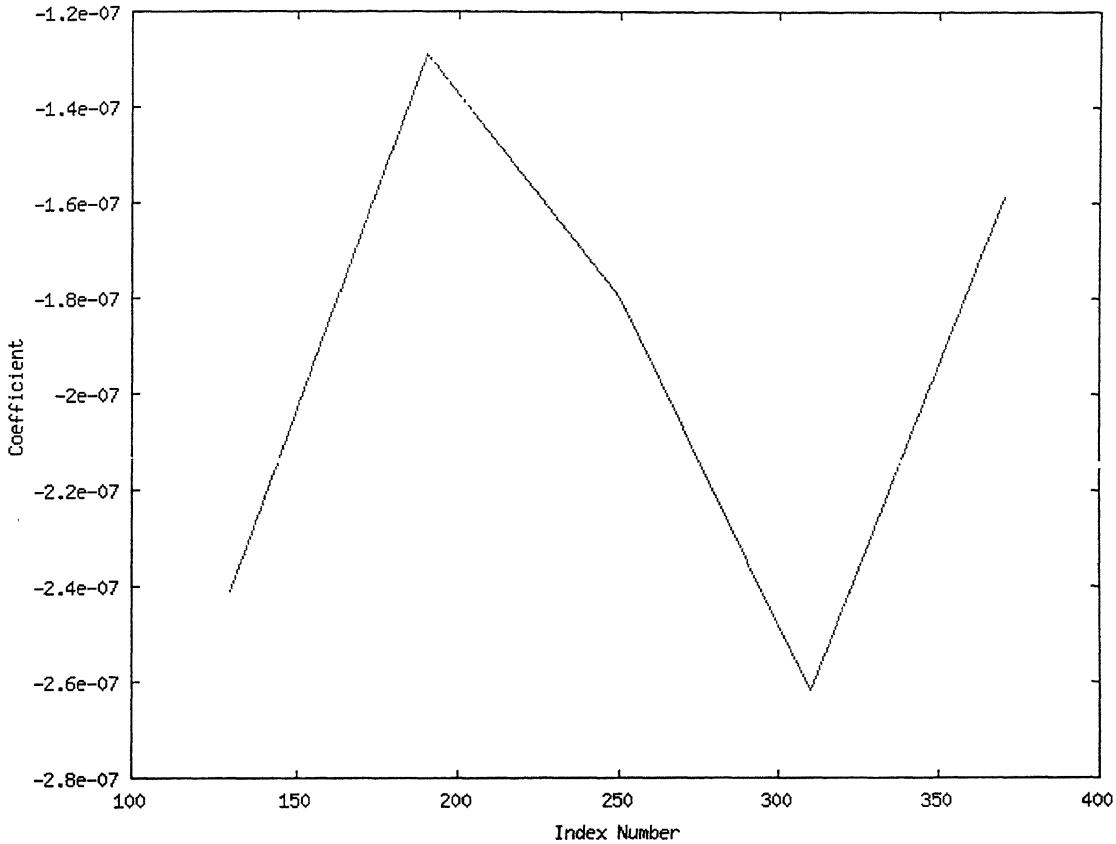

Fig 4.62 Variation of coefficient of SVOL in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

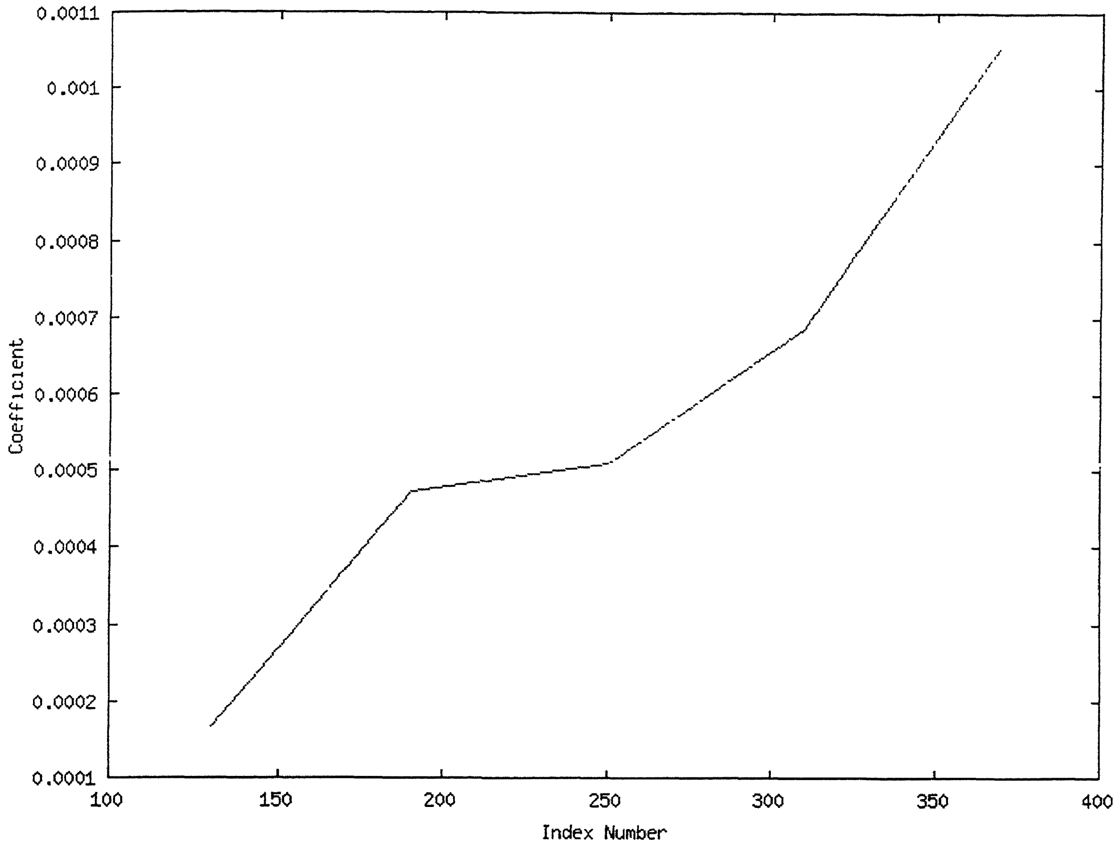

Fig 4.63 Variation of coefficient of HTR in different runs versus mean heat index number in runs in the linear prediction equation for P2 (For group 1 in which no RDOLO2 and ORE2 is added)

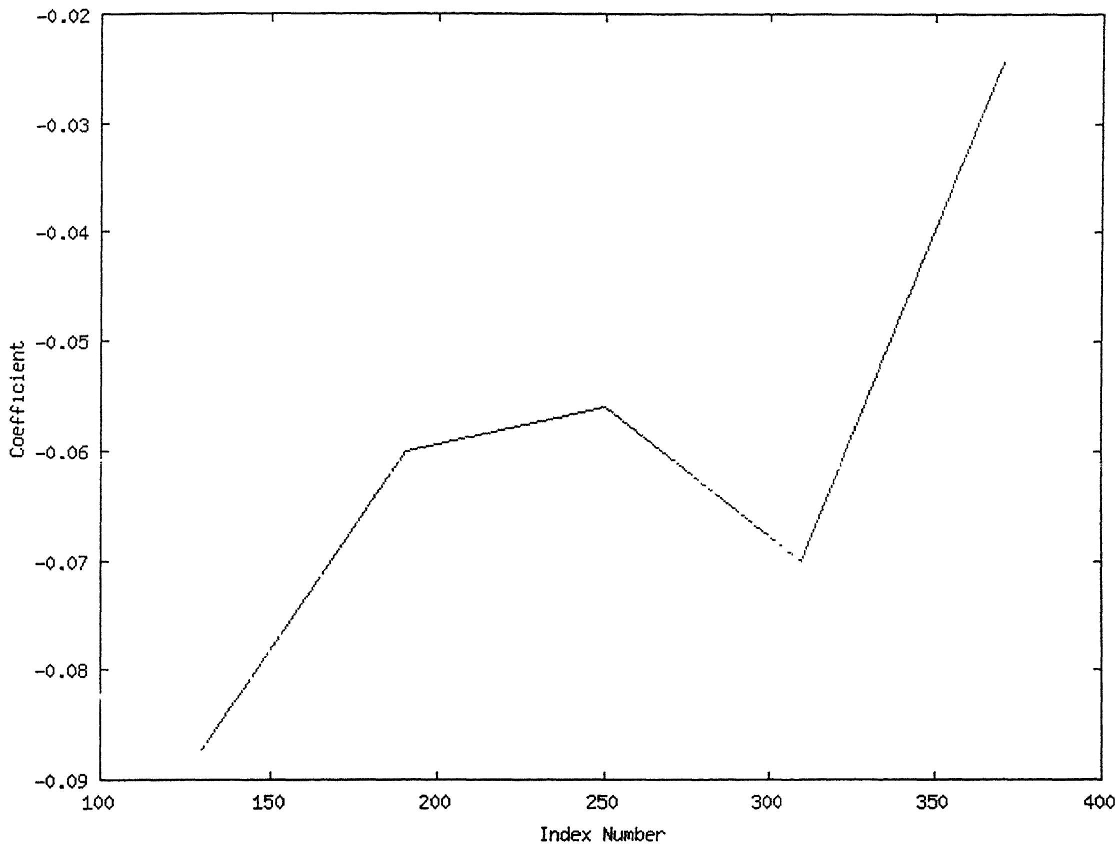

Fig 4.64 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for C2 (For group 1 in which no RDOLO2 and ORE2 is added)

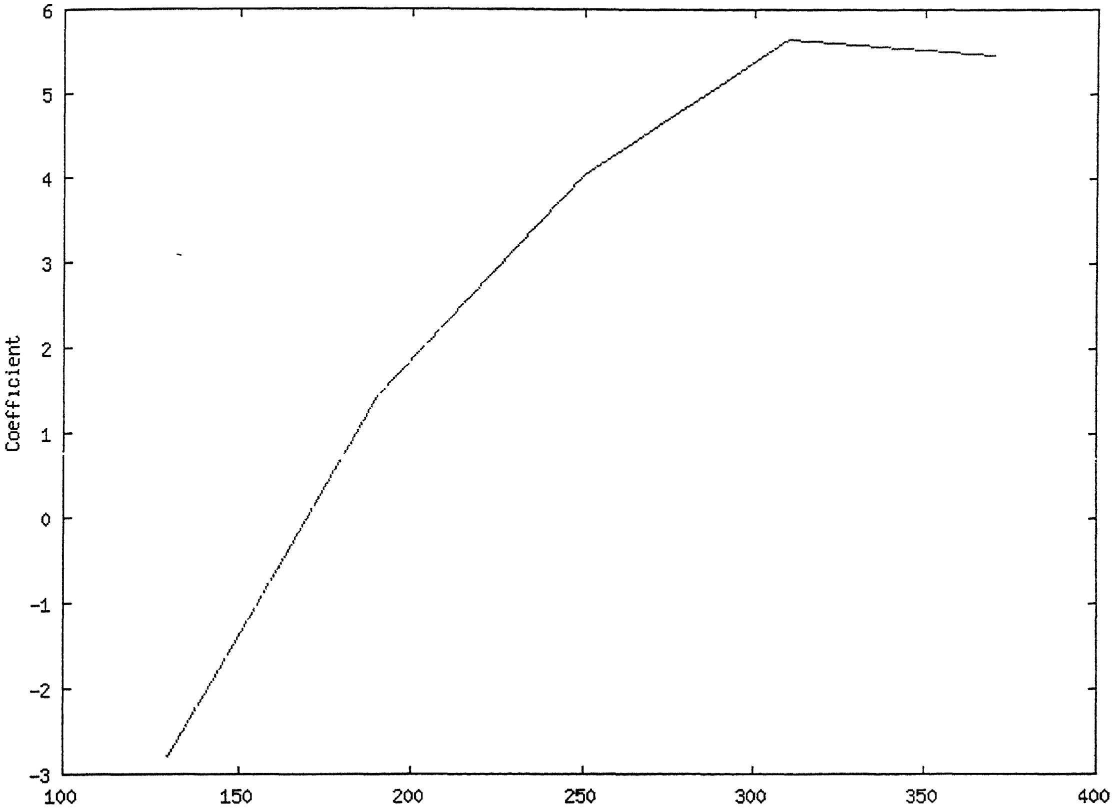

Fig 4.65 Variation of coefficient of HL2 in different runs versus mean heat index number in runs in the linear prediction equation for Oact2 (For group 1 in which no RDOLO2 and ORE2 is added)

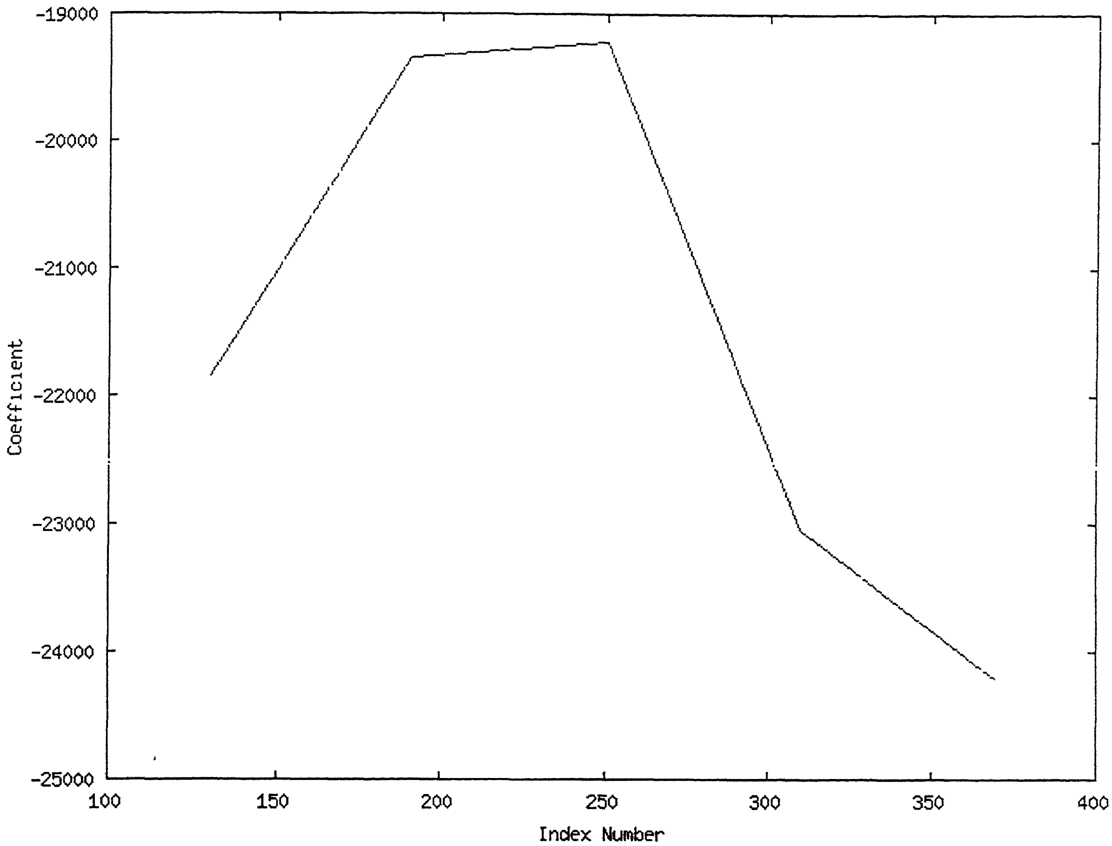

Fig 4.66 Variation of coefficient of C2 in different runs versus mean heat index number in runs in the linear prediction equation for Oact2 (For group 1 in which no RDOLO2 and ORE2 is added)

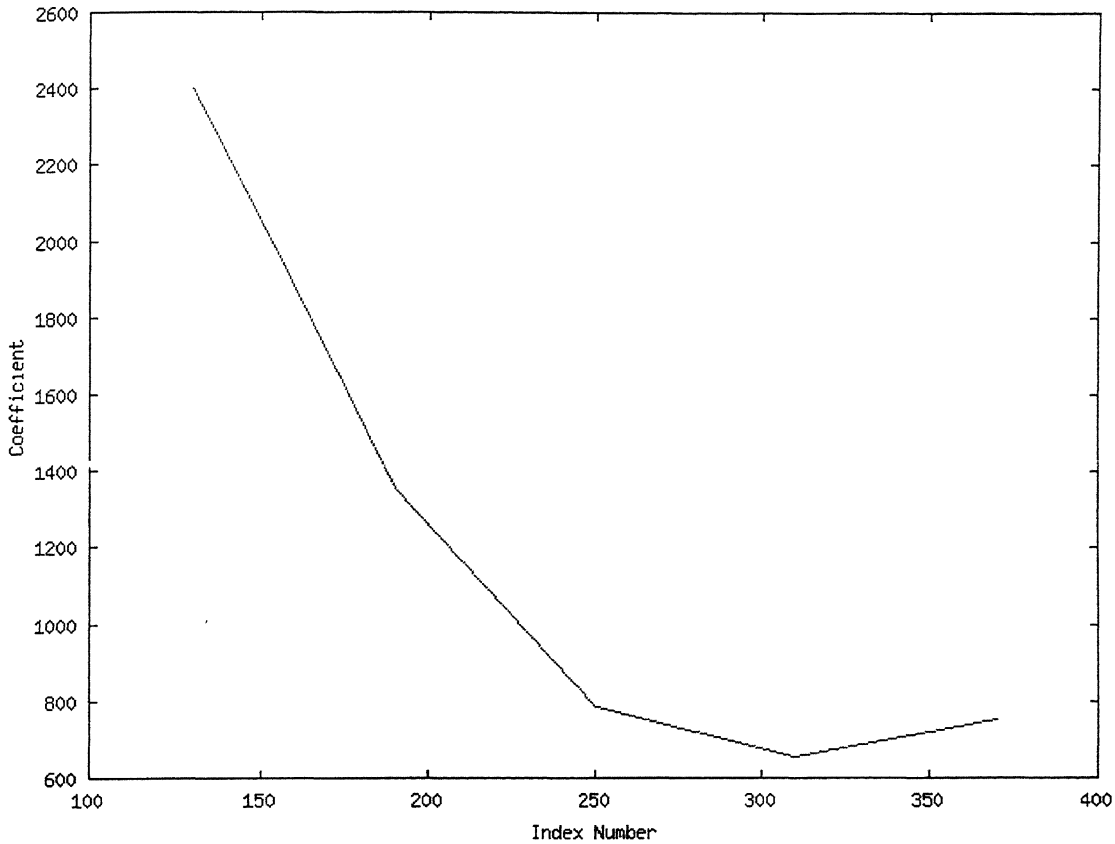

Fig 4.67 Variation of constant term in different runs versus mean heat index number in runs in the linear prediction equation for Oact2 (For group 1 in which no RDOLO2 and ORE2 is added)

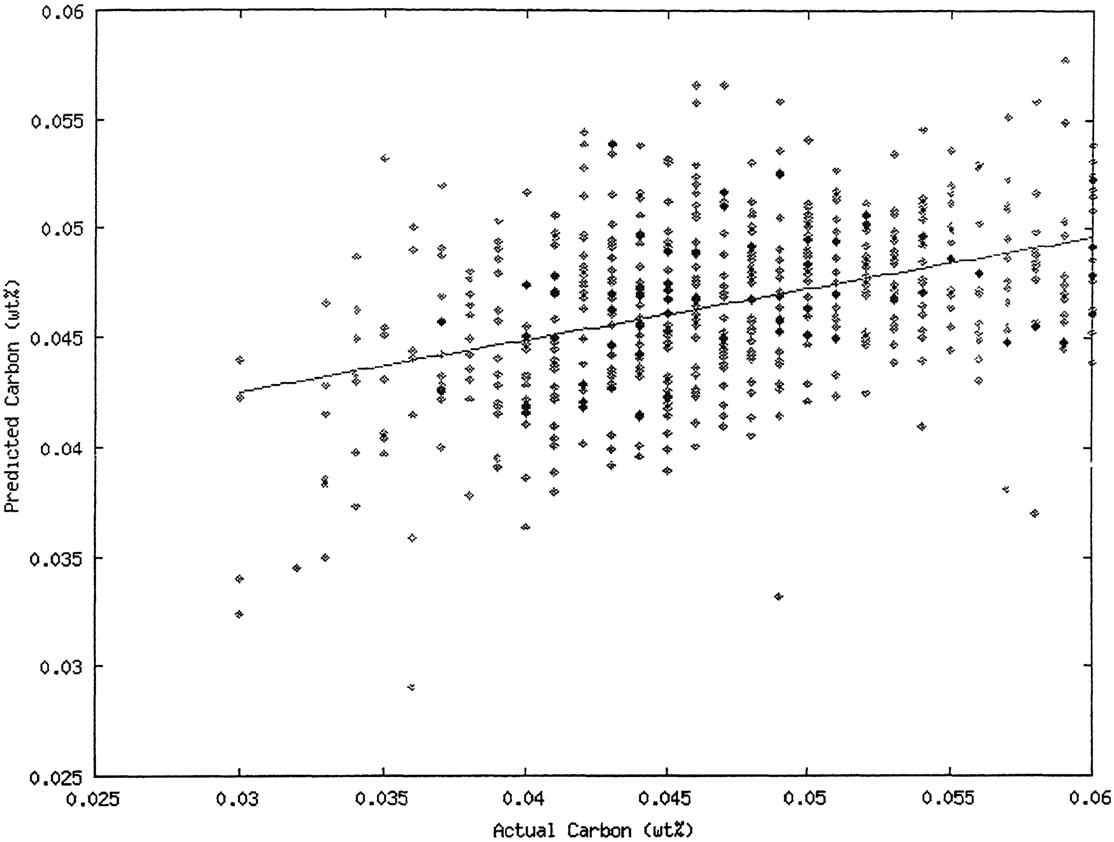

Fig 4.68 Prediction versus actual end point carbon using sequential linear prediction equations without sublance measurements (direct blow)

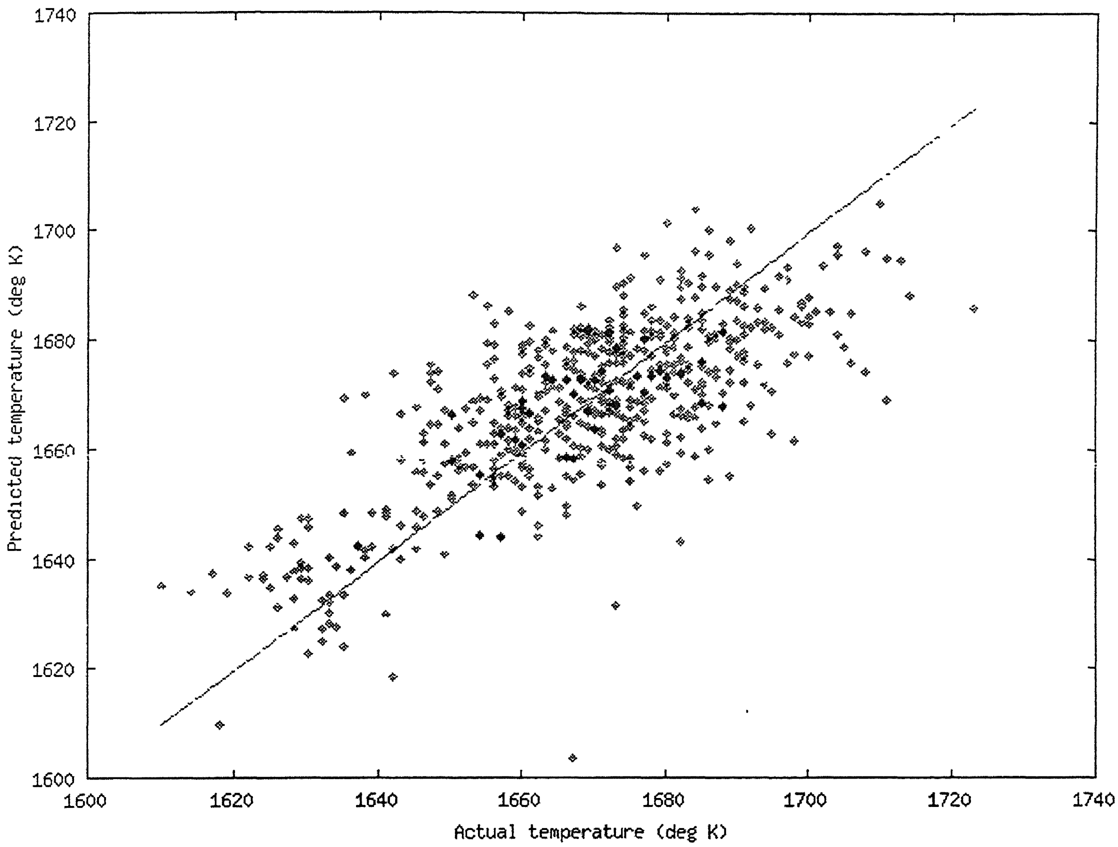

Fig 4.69 Prediction versus actual end point temperature using sequential linear prediction equations without sublance measurements (direct blow)

Table 4.45 Coefficient of various terms in sequential linear prediction models for end point carbon (direct blow)

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5	RUN#6	RUN#7
WBATH	8.6000e-08	3.1000e-08	6.3000e-08	3.5000e-08	-2.020e-07	-6.000e-09	-1.160e-07
GRY	2.8400e-07	3.6800e-07	1.9600e-07	3.4100e-07	6.7400e-07	5.2700e-07	5.0400e-07
C0	1.7308e-02	1.8670e-02	2.3413e-02	2.1271e-02	2.4896e-02	1.8631e-02	1.8212e-02
Mn0	1.5699e-02	4.3443e-02	6.9163e-02	8.5847e-02	2.1168e-02	7.6526e-02	1.9938e-02
P0	-2.858e-01	-2.616e-01	-2.341e-01	-2.868e-01	2.1659e-01	-2.708e-01	5.2529e-01
Si0	1.5828e-02	1.9209e-02	2.1244e-02	1.3915e-02	1.3212e-02	9.0387e-03	-2.156e-03
HL2	2.1241e-05	1.6603e-05	-1.427e-05	1.3758e-05	5.7278e-05	5.7621e-05	-1.647e-06
HTR	-3.723e-04	-5.975e-04	1.6276e-03	1.9781e-04	-2.494e-03	-2.114e-03	-3.679e-03
ORE1+ORE2	-1.216e-06	-1.062e-06	-1.027e-06	-8.400e-07	-6.610e-07	-6.910e-07	-2.180e-07
RSL1+RSL2	9.9500e-07	1.1040e-06	-4.690e-07	-6.930e-07	-9.560e-07	-5.510e-07	-1.560e-07
RDOLO1+RDOLO2	7.0700e-07	3.8900e-07	-4.780e-07	3.8000e-07	1.7760e-06	1.2820e-06	1.1870e-06
O21+O22	-6.983e-06	-6.380e-06	-5.668e-06	-7.142e-06	-7.953e-06	-7.983e-06	-4.855e-06
CONSTANT	-3.625e-02	-7.222e-02	-7.877e-02	-7.851e-02	-1.011e-01	-8.544e-02	-9.013e-02

Table 4.46 Coefficient of various terms in sequential linear prediction models for end point temperature (direct blow)

VARIABLE	RUN#1	RUN#2	RUN#3	RUN#4	RUN#5	RUN#6	RUN#7
WBATH	-3.821e-05	6.1886e-05	1.9047e-04	1.1760e-04	3.0869e-04	2.6616e-04	2.7059e-04
GSCHROT	-9.993e-04	-1.209e-03	-1.583e-03	-1.399e-03	-2.238e-03	-2.065e-03	-1.497e-03
C0	7.2966e+01	9.9113e+01	7.9196e+01	9.2203e+01	9.0456e+01	1.0243e+02	9.7091e+01
Mn0	5.7163e+01	4.3136e+01	-3.120e+01	-4.409e+01	6.7197e+01	1.0601e+02	7.8285e+01
Si0	1.4644e+01	-1.826e+01	-1.731e+01	4.5350e+01	5.9006e+01	1.0464e+02	9.5853e+01
LNSLF	-4.634e-02	-2.413e-02	4.4404e-02	1.8745e-02	2.8328e-02	2.6809e-03	-1.502e-02
HL2	1.5350e-01	1.7111e-01	1.0074e-01	6.3755e-02	3.5432e-02	3.9518e-02	1.7729e-01
HTR	4.8939e+00	2.0952e+00	-3.602e+00	-7.813e-01	-6.642e+00	-2.851e+00	2.5544e+00
BAS	-5.601e+00	-6.948e+00	-3.971e+00	1.7784e+00	2.4727e+00	5.2906e+00	3.5254e+00
LIM1+LIM2	-3.314e-04	1.4343e-03	6.6827e-04	-1.382e-03	-1.705e-03	-2.314e-03	-2.411e-03
ORE1+ORE2	-4.117e-03	-4.854e-03	-3.577e-03	-4.344e-03	-4.452e-03	-4.623e-03	-3.927e-03
RSL1+RSL2	-9.577e-04	-2.795e-03	-2.885e-03	-3.152e-03	-1.999e-03	-1.269e-03	-2.110e-04
RDOLO1+RDOLO2	-3.407e-03	-3.476e-03	-3.830e-03	-5.459e-03	-6.474e-03	-5.867e-03	-3.954e-03
O21+O22	1.5527e-02	8.7018e-03	1.1084e-02	1.1685e-02	1.2653e-02	1.0458e-02	1.0521e-02
CONSTANT	1.1317e+03	1.1163e+03	1.2163e+03	1.1357e+03	1.0987e+03	1.0153e+03	9.6745e+02

Chapter 5
Results of intelligent model

5.1 Introduction

We had earlier partitioned the dataset D1 into three groups based on the values of ORE2 and RDOLO2. First group contained heats in which neither ORE2 nor RDOLO2 were added. Second group contained heats containing RDOLO2 but no ORE2. Third group contained heats containing ORE2 but no RDOLO2. We have developed separate linear prediction equations for each group (Tables 4.1-4.15). When intelligent optimization model is applied to a particular heat, suitable linear prediction equations are inserted into the optimization model. Since linear prediction equations have been developed for three groups (as defined above) separately, the group to which the heat may belong should be known a priory. Thus, we can make any of the three assumptions about the group to which heat may belong and hence we can proceed with the optimization in three ways (or three options exist for the choice of control variables). Each option is to be evaluated in a separate optimization run.

5.2.1 NO raw dolomite and ore option

It is ideal if no coolant additions are needed during the end blow period (i.e. neither ORE2 nor RDOLO2 is added). This constitutes the first option and for optimization purposes the linear prediction equations for group 1 are inserted within model. Tables 4.1, 4.4, 4.7, 4.10 and 4.13 give prediction equations for group 1 for the dataset D1. From these tables we conclude that control variables for group 1 of heats are O22, LIM2, DOLO2 and HL2. These control variables are subjected to the following constraints, which must be respected during the end blow period.

Oxygen blown: $1100 \leq O22 \leq 3600$ (5.1)

Lime added: $0 \leq LIM2 \leq 500$ (5.2)

Dolomite added: $0 \le DOLO2 \le 2000$ (5.3)

Permissible lance height range

$$140 \le HL2 \le 250 \tag{5.4}$$

These limits for control variables are determined from operational practice at the plant.

5.2.2 Raw dolomite addition option

If assume that no ORE2 but some RDOLO2 may be added, the result of optimization constitutes the second option. In this case, we should insert the linear prediction equations developed for group 2.into the optimization model. Tables 4.2, 4.5, 4.8, 4.11 and 4.14 give prediction equations for group 2 for the dataset D1. From these tables we conclude that control variables for group 2 of heats are O22, LIM2, DOLO2, RSL2, RDOLO2 and HL2. These control variables are subjected to the following constraints, which must be respected during the end blow period.

Oxygen blown $1100 \le O22 \le 3600$ (5.5)

Lime added $0 \le LIM2 \le 500$ (5.6)

Dolomite added $0 \le DOLO2 \le 2000$ (5.7)

Return slag added $0 \le RSL2 \le 2500$ (5.8)

Raw dolomite added $0 \le RDOLO2 \le 4000$ (5.9)

Permissible lance height range

$$140 \le HL2 \le 250 \tag{5.10}$$

As in the case of first option, these limits for control variables are determined from operational practice at the plant.

5.2.3 Ore addition option

If we assume that no RDOLO2 but some ORE2 may be added the result of optimization constitutes the third option. In this case, we should insert the linear prediction equations developed for group 3 into the optimization model. Tables 4.3, 4.6, 4.9, 4.12 and 4.15 give prediction equations for the dataset D1. From these tables, we conclude that control variables for group 3 of heats are O22, LIM2, DOLO2, ORE2, RSL2 and HL2. These control variables are subjected to the following constraints, which must be respected during the end blow period.

Oxygen blown	$1100 \leq O22 \leq 3600$	(5.11)
Lime added	$0 \leq LIM2 \leq 500$	(5.12)
Dolomited added	$0 \leq DOLO2 \leq 2000$	(5.13)
Ore added	$0 \leq ORE2 \leq 1400$	(5.14)
Return slag added	$0 \leq RSL2 \leq 2500$	(5.15)
Permissible lance height range	$140 \leq HL2 \leq 250$	(5.16)

Like the other two options, these limits on control variables are determined from the operational practices at the plant.

5.3 Results of intelligent model for different options

The results of intelligent model on the dataset D1 are summarized in the Table A5.1 (presented in Appendix 5). For this dataset the aim values were taken to be the actual values. The table has four rows for each heat. First row gives the heat number, actual composition and actual values of process parameters. Second to fourth rows give the three options suggested by the intelligent model. Suggested process parameters and predicted composition values are given. Violations, if any, are also reported and the cost is also given. Violations are reported if the deviation from the window boundary exceeds certain limits, which are reported in Table 5.1. The results of intelligent model on the dataset D2, which contains aim values also, are summarized in the Table A5.2 (presented in Appendix 5). This table is similar to the Table A5.1 but it also contains a row for aim values for each heat.

5.3.1 Results of intelligent model on dataset D1

The dataset D1 did not contain any aim values thus we used actual values as aim values. Linear models developed for different groups in D1, as explained in Table 5.2, were used as control equations to predict carbon, temperature, manganese, phosphorus and dissolved oxygen. As discussed in chapter 4, the prediction equations are valid only if actual end point carbon is less than 0.06 wt%, so in each group we considered only those heats for which actual carbon was less than 0.06 wt%. The cost function, used was the same as described in chapter 2. The deviations from aim values (in this case actual values) are plotted in Figs 5.1-5.5. The costs for lowest cost options are given in Fig 5.6. It was found that in 17% cases only, the lowest cost option was the first option while in 39% cases the lowest cost option was the second option and in 44% cases the lowest cost option was the third option. It can be explained that in first option, there are only 4 controlling variables, while in second and third option; there are 6 controlling variables. Thus second and third options have more degrees of freedom in optimization than the first one and hence we usually get lower costs in second and third option than the first option.

5.3.1.1 Carbon window of dataset D1

Deviations of optimized predicted carbon from actual carbon are shown in Fig 5.1. Figure also shows the carbon window. Only for heat number 1801 the carbon window is violated by an amount greater than 0.0004%. For 127 heats the deviation is positive and for 146 heats the deviation is negative.

5.3.1.2 Temperature window of dataset D1

Deviations of optimized predicted temperature from actual temperature for lowest cost option are shown in Fig 5.2. Figure also shows the upper and lower limits of temperature window. Violations occur for heat numbers 1755, 2078, 2131, 2178, 2365, and 2499. For 196 heats the deviation is negative while the deviation is positive only for 77 heats. All the violations occur on the lower limit of window. This may be attributed to the fact that model actively uses various conditioners such as DOLO2, LIM2, etc to control the end point window while in current operating practice these conditioners are used sparingly. In 122 heats, suggested LIM2 is greater than 100 kg while in actual heats LIM2 exceeds100 kg, only in 12 cases. For example in heat number 1739 suggested LIM2 is 400 Kg while in actual heat, there was no LIM2 added. Similar is the case with other additions. Thus, predicted temperature is lower in most of the cases but lies within the control window. In this way, costs arising due to other variables were reduced at the cost of temperature deviation from aim value within the window. Further it was found that for these heats, which violated the temperature window the difference between end point temperature and sublance temperature was higher than average heats. Due to high actual end point temperature relative to sublance temperature, predicted temperature fell short of actual temperature.

5.3.1.3 Manganese window of dataset D1

Deviations of optimized predicted manganese from actual manganese for lowest cost option are shown in Fig 5.3. Figure also shows the upper limit of manganese window. There is no lower limit on manganese window. All the deviations lie in the window and

there is no case of violation. Most of the times predicted manganese is below actual manganese. This is explained by the fact that in 225 heats, suggested O22 is greater than the actual O22 while in only 46 heats, suggested O22 is less than the actual O22.

5.3.1.4 Phosphorus window of dataset D1

Deviations of optimized predicted phosphorus from actual phosphorus for lowest cost option are shown in Fig 5.4. Figure also shows the upper limit of phosphorus deviation, which is 0 deviation line since upper limit of phosphorus is the actual phosphorus. Violation of window occurs only for one heat, number 2446.

5.3.1.5 Dissolved oxygen window of dataset D1

Deviations of optimized predicted dissolved oxygen from actual dissolved oxygen for lowest cost option are shown in Fig 5.5. Figure also shows the upper and lower limits of dissolved oxygen window. In none of the heats the violation from the window limit exceeds 10 ppm, so no violations are reported. The deviations are on the both sides of actual, just like the case with carbon window.

5.3.1.6 Percent direct hits for dataset D1

A direct hit is said to occur if all end point variables, i.e. carbon, temperature, phosphorus, manganese, dissolved oxygen don't violate their respective windows. In case of dataset D1, violations occur only in heat numbers 1755, 1801, 2078, 2131, 2178, 2365, 2446 and 2499. Thus we get 265 direct hits out of total 273 heats. Thus percent direct hits for dataset D1 is 97%. Based on this percent direct hits value we can conclude that our optimization model performs fairly well on the dataset D1.

5.3.2 Results of intelligent model on dataset D2

Sequential linear prediction models as explained in Table 5.3, were used as control equations to predict carbon, temperature, manganese, phosphorus and dissolved oxygen. As discussed in chapter 4, the prediction equations are valid only if actual end point carbon is less than 0.06 wt%, so in each group we considered only those heats for which actual carbon was less than 0.06 wt%. The cost function, used was the same as described in chapter 2. The deviations from aim values (in this case actual values) are plotted in Figs 5.7-5.11. The costs for lowest cost options are given in Fig 5.12.

5.3.2.1 Carbon window of dataset D2

Deviations of optimized predicted carbon from actual carbon are shown in Fig 5.7. Figure also shows the carbon window. For no heat carbon window is violated by an amount greater than 0.0004%. For 107 heats the deviation is positive and for 76 heats the deviation is negative. We observe a inclination towards positive deviation. This can be explained if we observe the aim values and actual values of manganese and phosphorus. These aim values are much higher than actual values. Thus to achieve higher manganese and phosphorus aim the model tries to cut down the oxygen blown and this causes a positive deviation in carbon.

5.3.2.2 Temperature window of dataset D2

Deviations of optimized predicted temperature from actual temperature for lowest cost option are shown in Fig 5.8. Figure also shows the upper and lower limits of temperature window. Violations occur for heat numbers 2858, 2866,2872 and 2887. For 109 heats the deviation is negative while the deviation is positive only for 74 heats and for positive deviation heats, the deviations are very small. All the violations occur on the lower limit of window. This inclination toward negative deviation in temperature has been explained in section 5.3.2.2.

5.3.2.3 Manganese window of dataset D2

Deviations of optimized predicted manganese from actual manganese for lowest cost option are shown in Fig 5.9. Figure also shows the upper limit of manganese window. There is no lower limit on manganese window. All the deviations lie in the window and there is no case of violation. Most of the times predicted manganese is below actual manganese. This is because aim manganese is quite higher than actual manganese in most of the heats.

5.3.2.4 Phosphorus window of dataset D2

Deviations of optimized predicted phosphorus from actual phosphorus for lowest cost option are shown in Fig 5.10. Figure also shows the upper limit of phosphorus deviation, which is 0 deviation line since upper limit of phosphorus is the actual phosphorus. Violation of window does not occur for any heat.

5.3.2.5 Dissolved oxygen window of dataset D2

Deviations of optimized predicted dissolved oxygen from actual dissolved oxygen for lowest cost option are shown in Fig 5.11. Figure also shows the upper and lower limits of dissolved oxygen window. In none of the heats the violation from the window limit exceeds 10 ppm, so no violations are reported.

5.3.2.6 Percent direct hits for dataset D2

A direct hit is said to occur if all end point variables, i.e. carbon, temperature, phosphorus, manganese, dissolved oxygen don't violate their respective windows. In case of dataset D2, violations occur only in heat numbers 2858, 2866,2872 and 2887. Thus we get 179 direct hits out of total 183 heats. Thus, percent direct hits for dataset D1 is 97.8%. Based on this percent direct hits value we can conclude that our optimization model performs fairly well on the dataset D2..

Table 5.1
Reporting of violation of constraints for each of the variable

Variable	Violation limit
[C]	0.0004 %
T	1^0C
[Mn]	0.001 %
[P]	0.0001 %
[O]	10 ppm

Table 5.2 Summary of prediction equations used for optimizing heats of dataset D1

Option	ORE2	RDOLO2	Dataset used	Prediction Equation
Option 1: No raw dolomite and ore option	NO	NO	Dataset D1, Group 1 (Appendix 4)	Tables 4.1, 4.4, 4.7, 4.10,4.13
Option 2: Raw dolomite addition option	NO	YES	Dataset D1, Group 2 (Appendix 4)	Tables 4.2, 4.5, 4.8, 4.11,4.14
Option 3: Ore addition option	YES	NO	Dataset D1, Group 3 (Appendix 4)	Tables 4.3, 4.6, 4.9, 4.12,4.15

Table 5.3 Summary of prediction equations used for optimizing heats of dataset D2

Option	ORE2	RDOLO2	Dataset used	Prediction Equation
Option 1: No raw dolomite and ore option	NO	NO	Dataset D2, Group 1 (Appendix 4)	Tables 4.25, 4.26, 4.27, 4.28,4.29
Option 2: Raw dolomite addition option	NO	YES	Dataset D2, Group 2 (Appendix 4)	Tables 4.30, 4.31, 4.32, 4.33,4.34
Option 3: Ore addition option	YES	NO	Dataset D2, Group 3 (Appendix 4)	Tables 4.35, 4.36, 4.37, 4.38,4.39

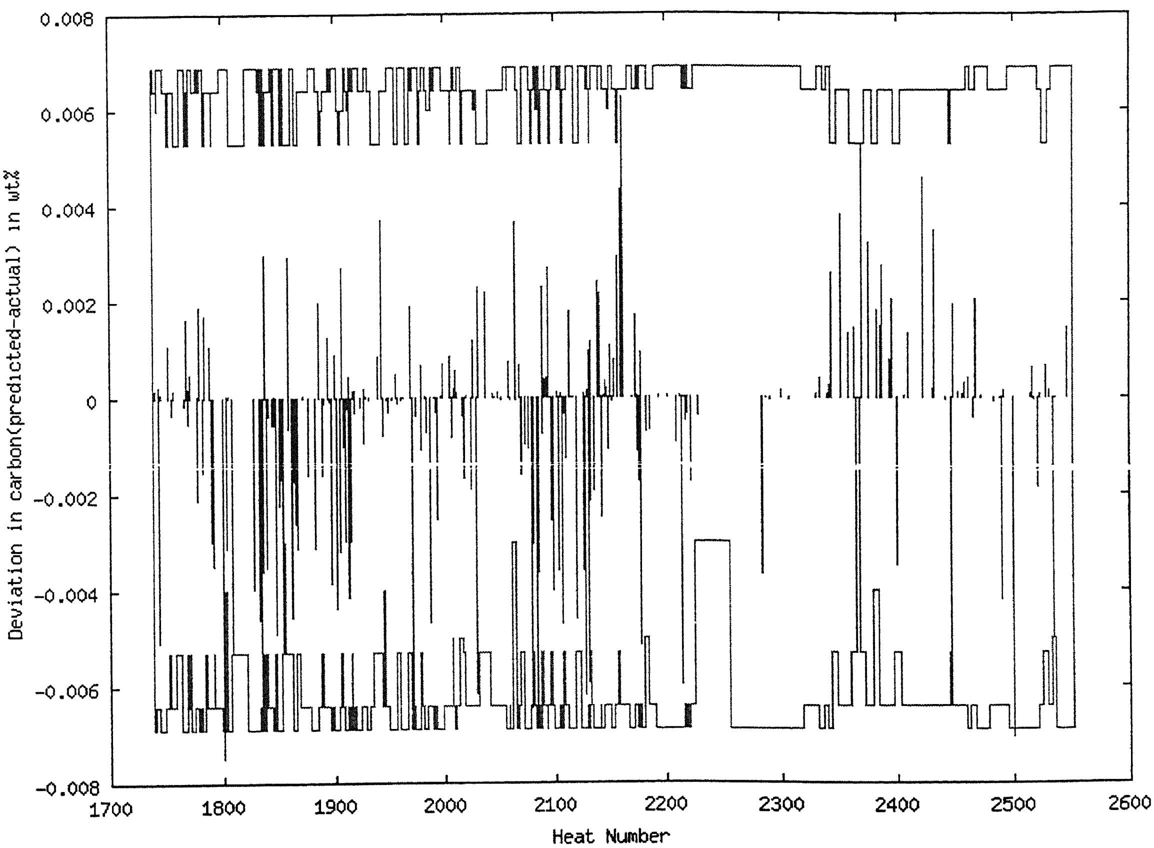

Fig 5.1 Carbon deviation (wt%) versus heat number for lowest cost option for dataset D1. Carbon window is also shown

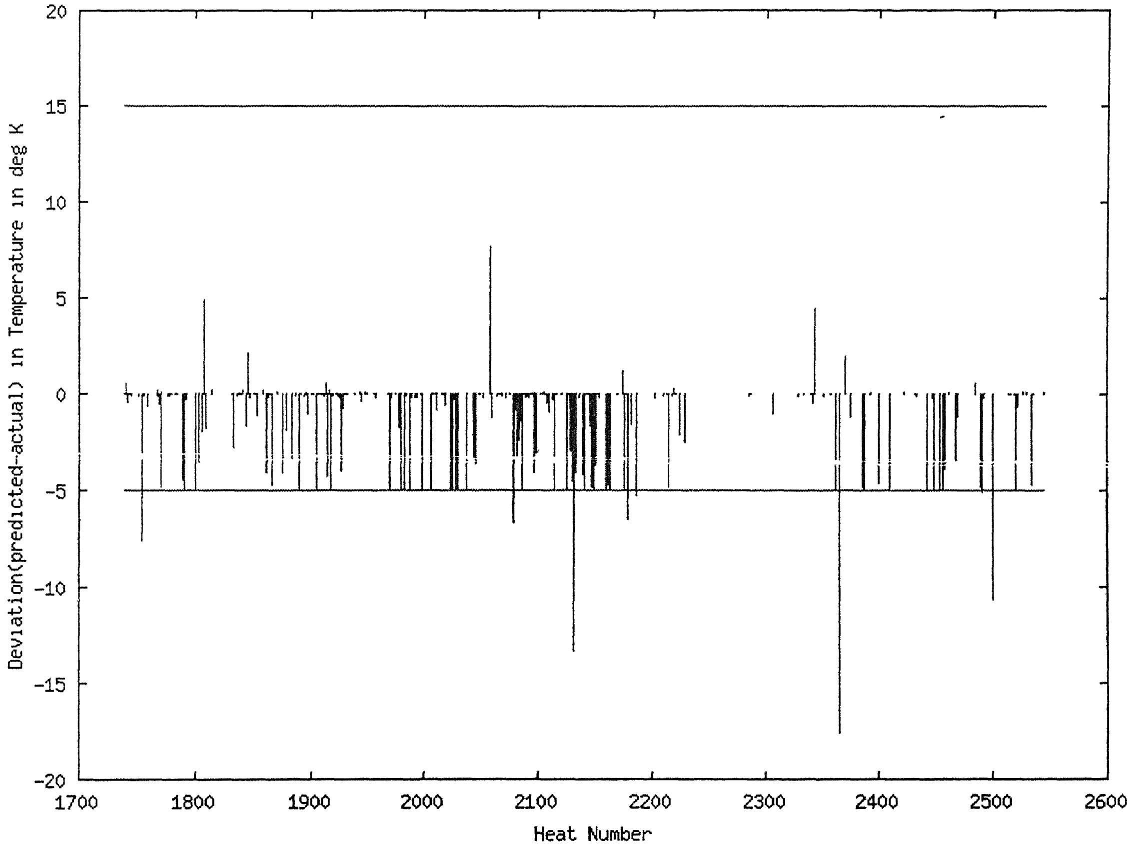

Fig 5.2 Temperature deviation (degree) versus heat number for lowest cost option for dataset D1. Temperature window is also shown.

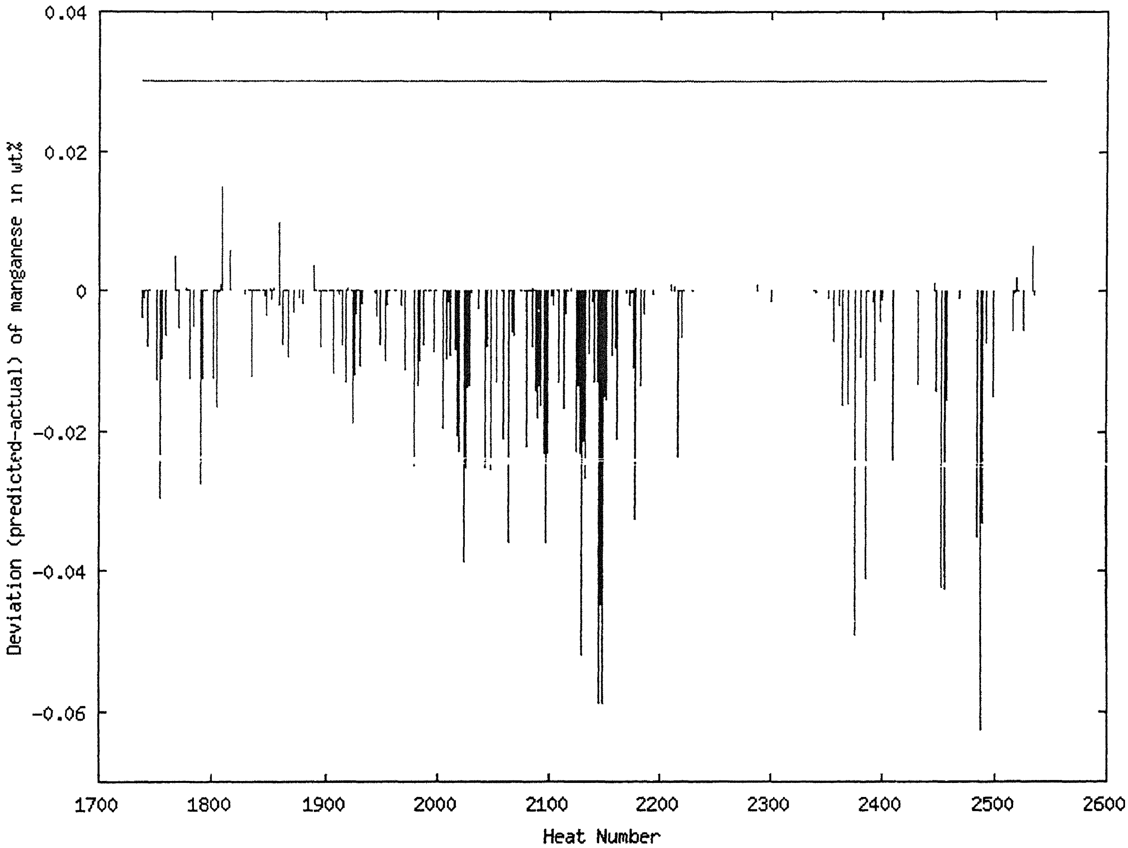

Fig 5.3 Manganese deviation (wt%) versus heat number for lowest cost option for dataset D1. Manganese window (only upper ceiling) is also shown.

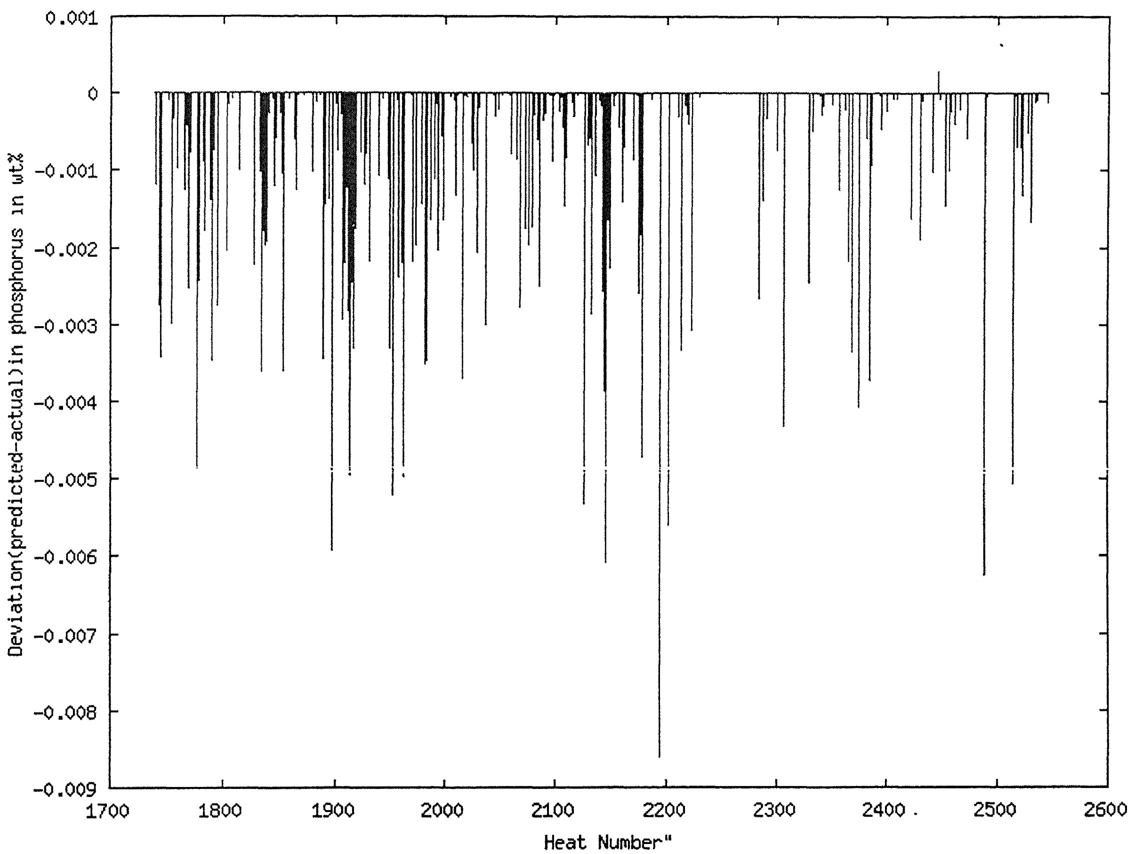

Fig 5.4 Phosphorus deviation (wt%) versus heat number for lowest cost option for dataset D1. Phosphorus window (only upper ceiling) is also shown.

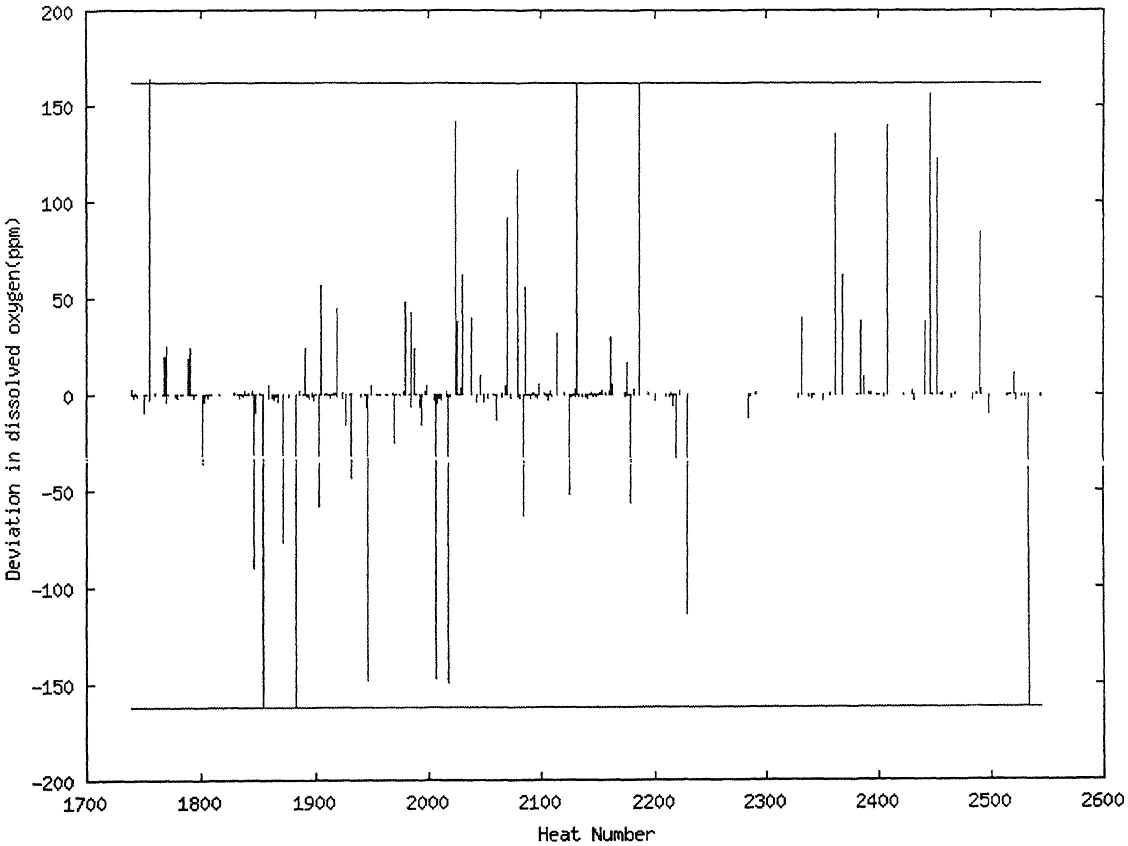

Fig 5.5 Deviation in Dissolved oxygen deviation (ppm) versus heat number for lowest cost option for dataset D1. Oxygen window is also shown.

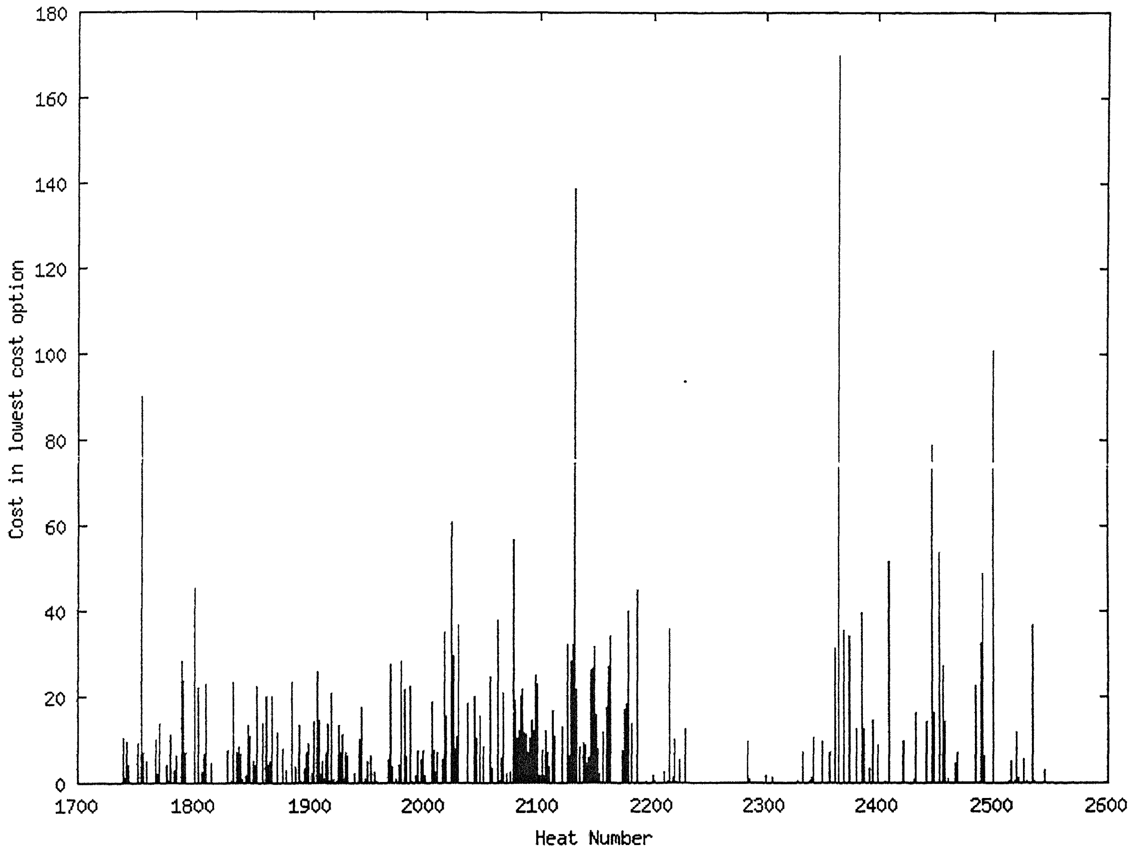

Fig 5.6 Cost for lowest cost options versus heat number for dataset D1

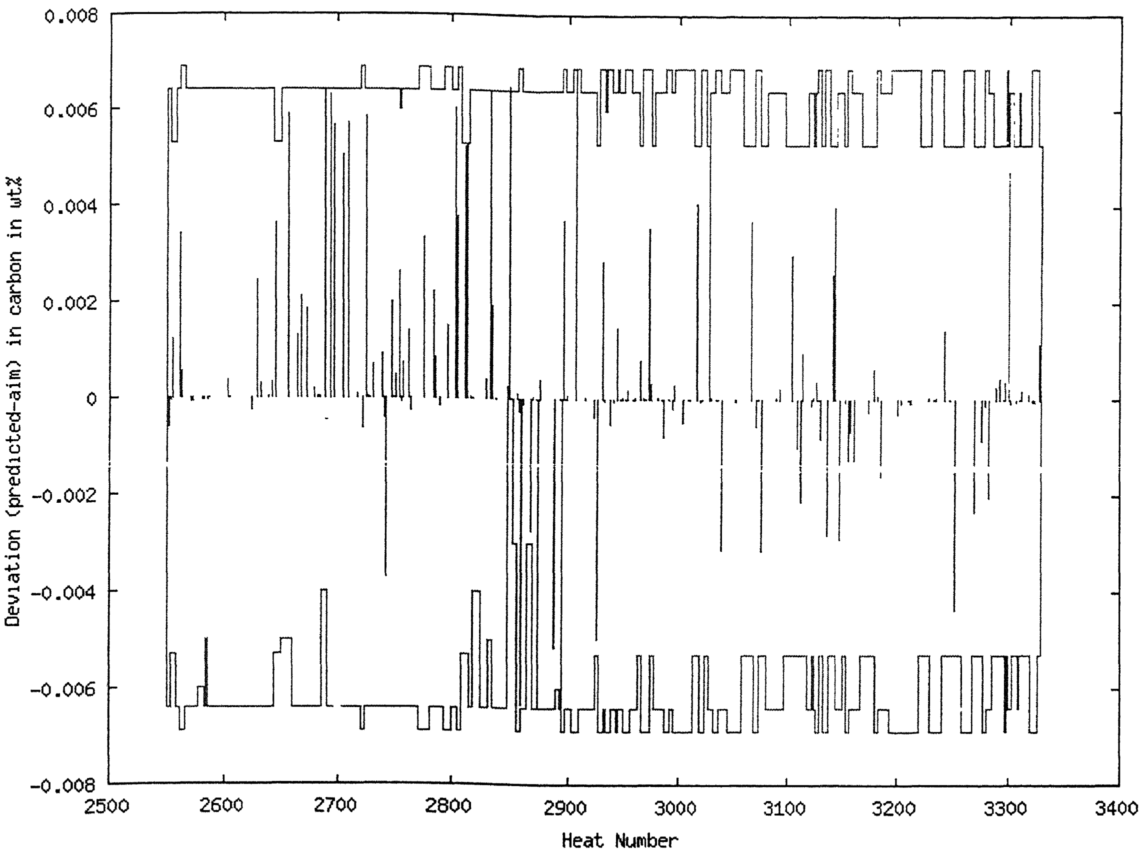

Fig 5.7 Carbon deviation (wt%) versus heat number for lowest cost option for dataset D2.Carbon window is also shown

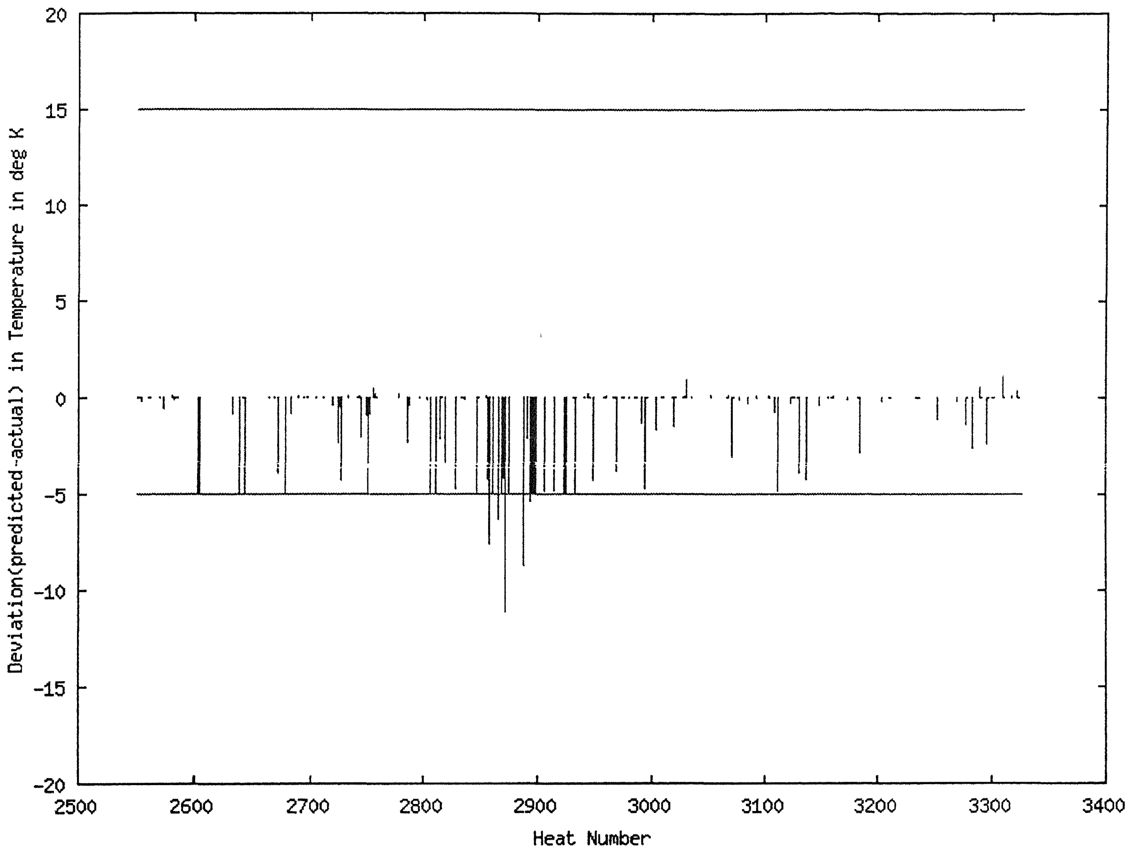

Fig 5.8 Temperature deviation (degree) versus heat number for lowest cost option for dataset D2. Temperature window is also shown

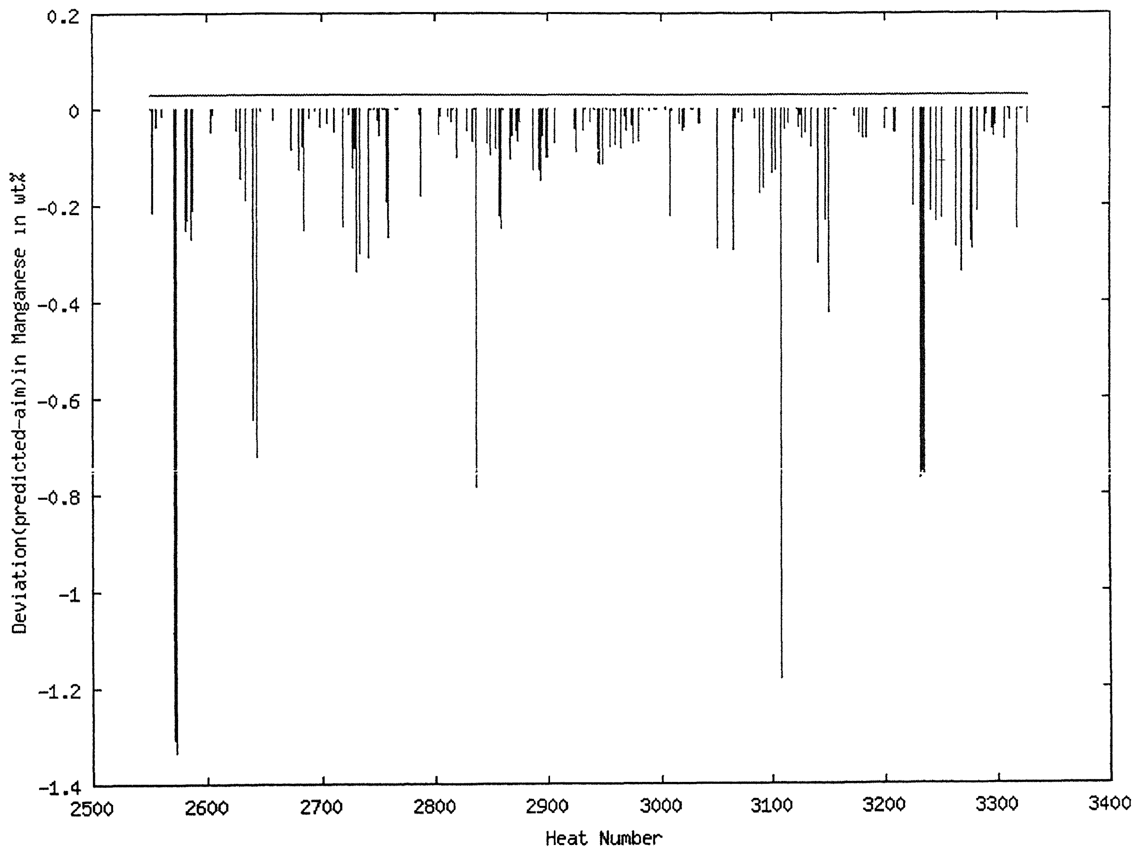

Fig 5.9 Manganese deviation (wt%) versus heat number for lowest cost option for dataset D2. Manganese window (only upper ceiling) is also shown

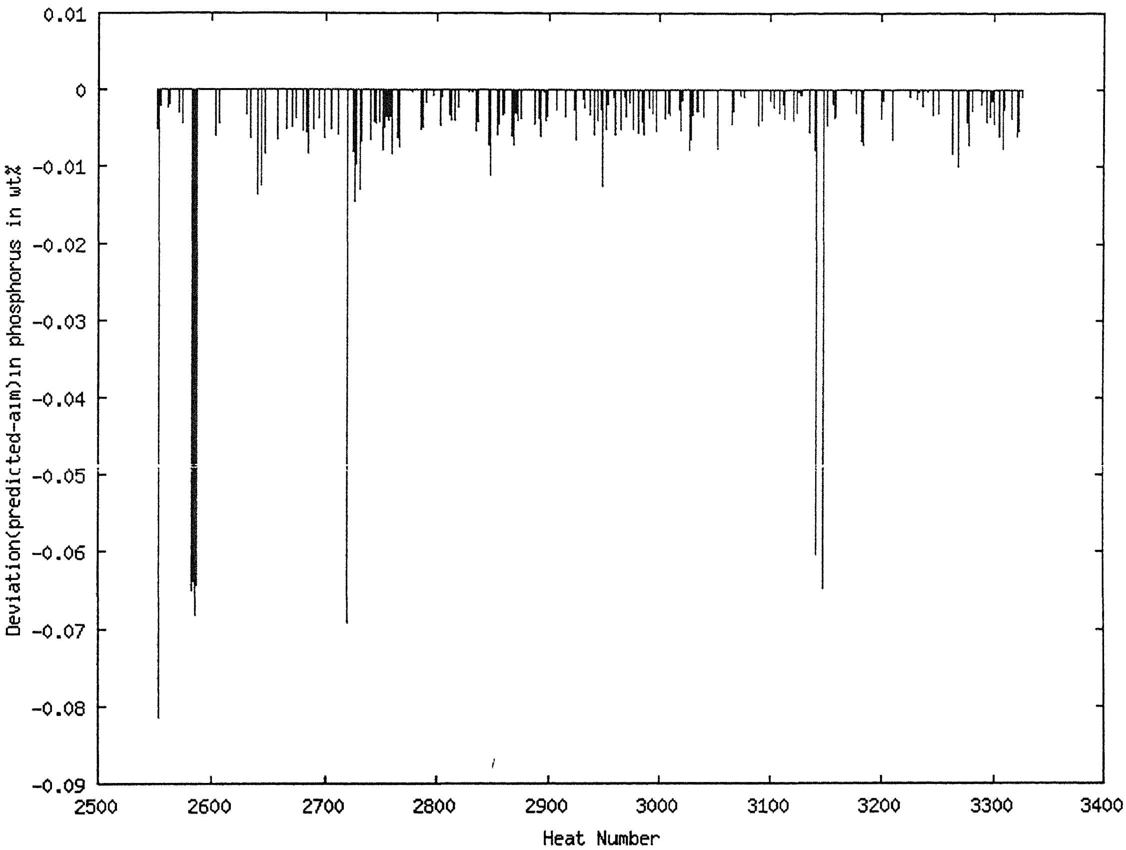

Fig 5.10 Phosphorus deviation (wt%) versus heat number for lowest cost option for dataset D2. Phosphorus window (only upper ceiling) is also shown

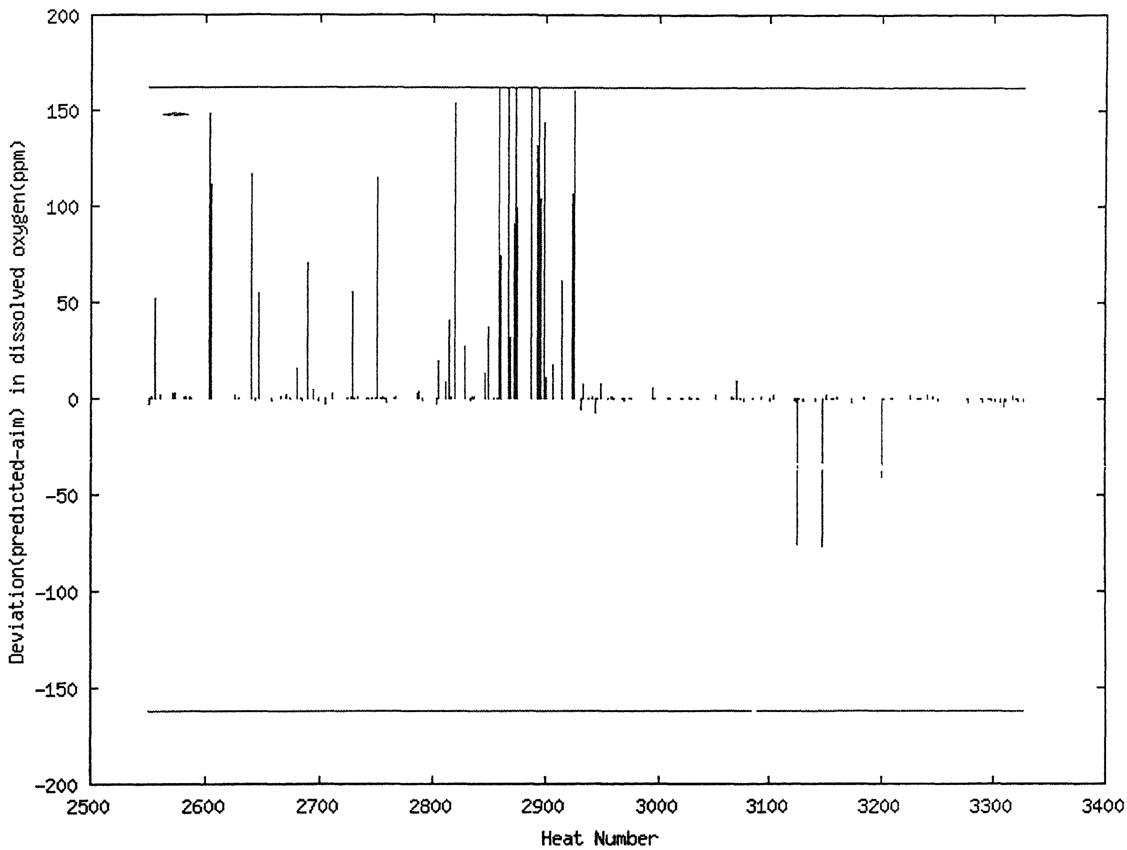

Fig 5.11 Deviation in Dissolved oxygen deviation (ppm) versus heat number for lowest cost option for dataset D2. Oxygen window is also shown

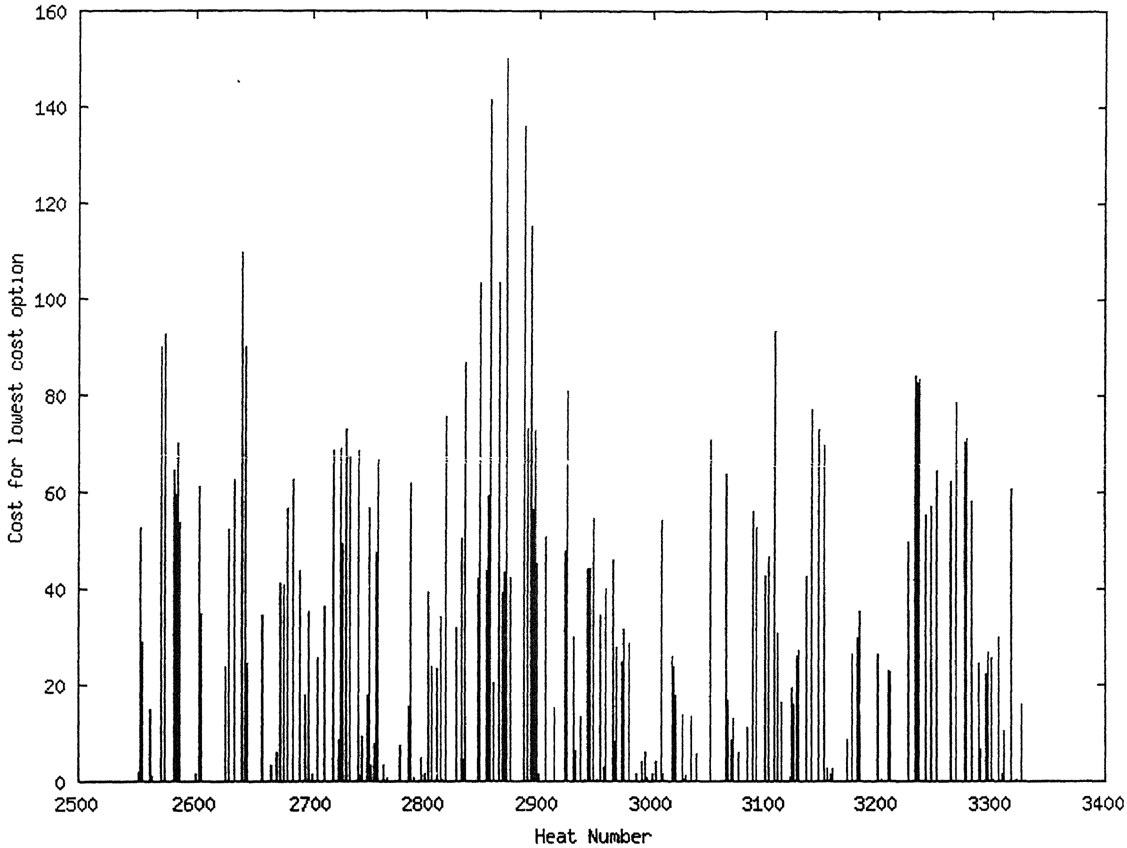

Fig 5.12 Cost for lowest cost options versus heat number for dataset D2

Chapter 6
Conclusions and Suggestion for Further work

6.1 Conclusions

1. Linear prediction models are developed using dataset D1. These prediction models do fairly well on dataset D1 but when we applied them to datasets D2, D3 and D4, the errors in end point prediction increases with increasing campaign life. Thus it is concluded that single set of linear prediction equation cannot give good results over a long range of time.
2. Sequential linear prediction models are developed using datasets D1-D4. In sequential linear prediction models the data file used for regression is updated every 60 heats. With sequential linear prediction models, the errors in end point prediction decreases. The coefficients of linear prediction models were plotted with campaign life. Regular patterns are found in some of the plots, while some of the plots have sudden variation of coefficients.
3. Sequential linear prediction models are developed for direct blow heats. Direct blow linear prediction models have errors higher than errors in sublance linear prediction models, but directblow models can be useful for some grades of steel where composition and temperature control is not that crucial.
4. Window around end point compositions are defined. Our aim is to prepare heats falling within window. An objective function is formulated based on this window formulation.
5. Micro genetic algorithm is applied to datasets D1 and D2 for deciding optimum process variables. In more than 97% of heats, we can reach within a narrow range of target temperature and composition for the dataset D1 and D2.

6.2 Suggestion for further work

1. We only used linear prediction models to predict end point composition and temperature. Non linear models can also be tried.
2. In sequential linear prediction models, we observed linear and exponential trends in some of the plots. This needs to be further explored so that there is no need to run regression all the time. Ideal case would be if we are able to predict the coefficients with increasing campaign life. Time series analysis can also be tried in this regard.
3. In our optimization function, we did not consider costs of operating variables themselves (for example the cost of blowing oxygen or adding ore). These costs can be added to objective function for a more realistic picture.

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Appendix 1
Review of Models for End Point carbon and Temperature prediction using sublance data

2.1 Introduction

Sublance is used in oxygen steelmaking to take a sample and also determine instantaneously the steel composition 3-4 minutes before the end of blow. This analysis is used to determine the amount of oxygen to be blown in remaining part of the blow so as to arrive at a predefined carbon and temperature at the end. Thus, we are concerned with the modeling of trajectory of process during the last few minutes of converter operation. Metal sample is also taken at the end of blow to verify carbon, phosphorus, manganese, dissolved oxygen and temperature achieved. While the blow is in progress, adjustment of lance height can be done and judicious addition of iron ore, raw dolomite and solidified slag(return slag from converter) can be made to control the trajectory of carbon as well as temperature. Since the concentrations of carbon and oxygen are related to each other, carbon may also be predicted using the dissolved oxygen content and vice versa. Hence the models for prediction of end point carbon, temperature, phosphorus, manganese and oxygen from sublance data play an important role in determining the amount of oxygen to be blown during second blow period and thereby achieve the aim composition of steel. This chapter briefly reviews the models published in literature.

2.2.1 Model by Distin, Hallet and Richardson

Distin, Hallet and Richardson [9] have assumed in their study on the decarburization of liquid Fe-C alloys with O2 and CO-CO2 mixtures that the concentration of carbon at the surface becomes virtually zero at the instant of oxide formation. When the oxide appears on the surface, rate of decarburization can be written as

$$R_C = \frac{k_c A}{V}(n_c^b)$$

where R_C is rate of decarburization(mol/sec), k_C is mass transfer coefficient of carbon(m/sec) n_c^b is concentration of carbon in bulk and A, V are the area and volume of droplet respectively in SI units. Above equation can be rewritten as

$$-\frac{d[\%C]}{dt}=\frac{k_c A}{V}[\%C]^b$$

where [%C} is carbon concentration in weight percent and superscript b denotes bulk.
For spherical droplets

$$k_c=\frac{5D}{a}$$

where D is diffusivity of carbon, a is radius of droplet.

2.2.2 Model by Bessho et al.

Bessho et al. [10] have developed a dynamic model, based on exponential dependence of decarburization rate on carbon content. This model has been applied to estimate carbon content and temperature of Q-BOP heats after the sublance measurement. End point carbon content at any arbitrary time after the measurement by the sensor lance can be calculated, by the equation

$$C_{fa}=(C_0-C_p)\ln\left[\frac{R}{1-\exp\frac{C_0-C_{SL}}{C_p-C_0}+R\exp\frac{C_0}{C_p-C_0}}\right]$$

where $R=\exp\frac{\xi.\Delta O_2-C_{SL}}{C_p-C_0}$. Here ΔO_2 is the amount of oxygen blown after the measurement by sensor lance. C_{SL} is carbon content determined by sensor lance, C_0 is

critical carbon content below which decarburization does not substantially occur and is found to be 0.01% for Q-BOP. ξ is the theoretical maximum decarburization rate,. C_p is a parameter derived statistically based on operational variables. Bessho et al. used a semi empirical equation to estimate the temperature rise.

$$T_f = T_{SL} + P.\Delta O_2 + Q.\left[\frac{1}{C_f} - \frac{1}{C_{SL}}\right] + R$$

where T_f, C_f are the temperature and carbon content of the bath at blowing end respectively. T_{SL}, C_{SL} are the temperature and carbon content of the bath measured by sublance. ΔO_2 is amount of blowing after sublance measurement and P,Q,R are parameters which are calculated from multiple regression analysis by using actual operational data.

2.2.3 Model by Byun et al.

Byun et al. [11] employed a simplified form of exponential model and they also incorporated the effect of other operational variables on oxygen consumption by multiple linear regression. The final equation for amount of oxygen to blown to achieve the target carbon content at the end point is given by

$$\Delta O_{2,cal} = \frac{W_{st}}{\alpha\beta}\left[\beta(C_e - C_S) - \ln\left[\frac{1-\exp-\beta(C_e - C_S)}{1-\exp-\beta(C_S - C_e)}\right] + \sum_i \gamma_i(X_i - \overline{X}_i) + \gamma_0\right]$$

where C_e is target end point carbon content, C_S is sublance carbon content, α is maximum theoretical decarburization rate, $\beta = \frac{1}{C_p - C_0}$ where C_p and C_0 are same as defined in section 2.2.2. W_{st} is weight of molten steel (kg). γ_i= regression coefficient, γ_0=regression constant, X_i=operational variables, $\overline{X}_i$=standard operational variables. Temperature rise can be calculated by the equation

$$\Delta T = \varepsilon_1 (C_S - C_e) + \varepsilon_2 \frac{1}{C_e - C_S} + \varepsilon_3 \Delta O_2 + \sum_i \gamma_i (X_i - \overline{X}_i) + \gamma_0$$

where ε_i is regression coefficient.

Appendix 2
ReadMe file of GA Program

Below is the text which is contained in ReadMe file of GA program. This is helpful in understanding and running the program.

D.L. Carroll's FORTRAN Genetic Algorithm Driver

This is version 1.7, last updated on 12/11/98.
Download from: <http://www.staff.uiuc.edu/~carroll/ga.html>

Copyright David L. Carroll; this code may not be reproduced for sale or for use in part of another code for sale without the express written permission of David L. Carroll.

This genetic algorithm (GA) driver is free for public use. My only request is that the user reference and/or acknowledge the use of this driver in any papers/reports/articles which have results obtained from the use of this driver. I would also appreciate a copy of such papers/articles/reports, or at least an e-mail message with the reference so I can get a copy. Thanks.

This program is a FORTRAN version of a genetic algorithm driver. This code initializes a random sample of individuals with different parameters to be optimized using the genetic algorithm approach, i.e. evolution via survival of the fittest. The selection scheme used is tournament selection with a shuffling technique for choosing random pairs for mating. The routine includes binary coding for the individuals, jump mutation, creep mutation, and the option for

single-point or uniform crossover. Niching (sharing) and an option for the number of children per pair of parents has been added. More recently, an option for the use of a micro-GA has been added.

For companies wishing to link this GA driver with an existing code, I am available for some consulting work. Regardless, I suggest altering this code as little as possible to make future updates easier to incorporate.

Any users new to the GA world are encouraged to read David Goldberg's "Genetic Algorithms in Search, Optimization and Machine Learning," Addison-Wesley, 1989.

The seven FORTRAN GA files are: ga170.f
ga.inp
ga2.inp (w/ different namelist identifier)
ga.out
ga.restart
params.f
ReadMe (this file!)

I have provided a sample subroutine "func", but ultimately the user must supply this subroutine "func" which should be your cost function. You should be able to run the code with the sample subroutine "func" and the provided ga.inp file and obtain the optimal function value of 1.0000 at generation 187 with the uniform crossover micro-GA enabled (this is 935 function evaluations). Note that because different computers may treat precision and truncation differently, I have seen cases where two computers using the same input produce different evolution histories (but still converge to the optimal).

I still recommend using the micro-GA technique (microga=1) with uniform crossover (iunifrm=1). However, if possible, I strongly suggest that you use values of nposibl of 2**n (2, 4, 8, 16, 32, 64, etc.). While my test function works fine for other values of nposibl, I have encountered problems where the uniform crossover micro-GA has difficulty with parameters having long bit strings and a non-2**n value of nposibl, e.g. nposibl=1000, will have 10 bits assigned (for this case I would suggest running nposibl=1024 rather than 1000); I am presently investigating possible fixes for this situation.

Updates:

Version 1.7 includes several improvements:

(i) The coding and input files are cleaned up to provide identical output across a wider range of computers.

(ii) The arrays have been rearranged to enable a more efficient caching of system memory. For cases with very large population sizes, run time improvements of as much as a factor of 4-6 were observed! For population sizes less than 1000 you will not see much change.

(iii) A summary of the results has been added to the end of the output file.

(iv) An alternate input file "ga2.inp" has been included. Some compilers require an '&' and a '/' in the namelist input file, rather than '$' signs.

(v) For those wishing to try ever harder test functions, the included function is now N-dimensional, where N is simply determined by the number of parameters specified (nparam).

Version 1.6.5 of the code allowed creep mutations to be implemented

with the micro-GA technique. (This version was never officially released.)

Version 1.6.4 of the code has a minor modification to the niching routine and another minor modification which would only affect a user having a single parameter with more than 2**30 possibilities (probably noone has used this large a number).

Version 1.6.3 of the code fixes a bug in the niching routine. Niching should now work much better than in previous versions. A few other minor changes have been made (not worth mentioning). The sample function has been changed to something a bit more challenging.

Version 1.6.2 of the code has had major restructuring in the form of converting all of the operators (crossover, mutation, etc.) into subroutines. The code logic should be a little more understandable now and it lends itself to more easily modifying parts of the code. The counter kountmx (see v1.6.1 comments below) was added to the namelist input. Otherwise, code performance should be the same.

Version 1.6.1 of the code has very minor modifications. If you are already successfully using the code, then you will not need this update.

(i) Added a little documentation about changing format statements 1050, 1075, 1275, and 1500 when you change nparam or the total number of chromosomes (see below).

(ii) I have commented out all of the lines of code dealing with cputime. The Macintosh specific SECNDS call was causing more questions than I had anticipated. However, other than commenting the lines out, I have left them in their location for reference in case the user wants a cputime added.

(iii) I have included a sample output file.

(iv) Added counter (kountmx) to control how frequently the restart file is written. This saves I/O time and wear and tear on storage device. Presently set to write every fifth generation.

Version 1.6 of the code has incorporated the ability to use a micro-GA approach; this significantly reduced the number of function evaluations to find the global maximum of my test function.

Version 1.5 of the code has added some more flexibility to your available options:

(i) You now specify the minimum and maximum values of the parameters rather than the minimum and the increment.

(ii) You now specify the number of possibilities you want for each parameter, not the number of bits. This modification has two features: first, the program automatically calculates the number of bits per parameter; second, you are no longer forced to have a number of possibilities equal to 2**n. While the code is more efficient when there 2**n possibilities per parameter, it will run quite well with a lesser number; e.g. a colleague has 25 specific airfoil families he wants to investigate, greater than 16, less than 32.

(iii) You can now specify specific parameters for niching. Earlier versions of the code forced you to niche on all parameters. Now, the input array 'nichflg' permits you to choose the parameters for niching.

(iv) You have an input flag to prevent the printing of specific jump. and creep mutation information

(v) You now specify the maximum values of population size, number of parameters and number of chromosomes in an include file (params.f). This sets the maximum array sizes in the code. When running, the

code only uses the array size up to npopsiz and nparam (from ga.inp) and nchrome (computed internally from the nposibl input array).

The code is presently set for a maximum population size of 200, 30 chromosomes (binary bits) and 2 parameters. These values can be changed in params.f as appropriate for your problem. Correspondingly you will have to change a few 'write' and 'format' statements if you change nchrmax and/or nparmax. In particular, if you change nchrome and/or nparam, then you should change the 'format' statement numbers 1050, 1075, 1275, and 1500. For example, if you have a problem with 4 parameters and 16 chromosomes (bits), then you should change these format statements to be:

```
 1050 format(1x,' #     Binary Code',8x,'Param1 Param2 Param3',
    +        ' Param4 Fitness')
 1075 format(i3,1x,16i1,4(1x,f6.2),1x,f6.2)
 1275 format(/' Average Values:',10x,4(1x,f6.2),1x,f6.2/)
 1500 format(i5,3x,16i2)
```

The CPU time related lines of code reference a Macintosh specific time function (SECNDS). To avoid compiler errors with other computers, I have commented out these lines of code. If you wish to have cputime output,then you will have to change the time functions for the specific computer you are running on. Most modern Unix machines will recognize the 'etime' function; these lines are added to the code along with the variable 'tarray' and 'cpu...again, to avoid compiler errors with different computers, these lines of code are also commented out.

A common problem arises with the Microsoft PowerStation compiler, i.e., PowerStation does not recognize the abbreviation NML for NAMELIST. If you are using PowerStation, you will likely have to substitute NAMELIST

for all instances of NML.

Please feel free to contact me with questions, comments, or errors
(hopefully none of latter).

Enjoy!

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fax: 217-244-6534

##
#######

micro-GA Tip:

My favorite GA technique is still the micro-GA. At this point, I recommend using the micro-GA with uniform crossover and a small population size. The following inputs gave me excellent performance:

microga = 1
npopsiz = 5
maxgen = 100
iunifrm = 1

I have also gotten good performance with the single-point crossover (iunifrm=0), micro-GA.

If you decide to use the micro-GA, you will not need to worry about the population sizing or creep mutation tips below.

See the Krishnakumar reference below for more information about micro-GA's.

##
########

Population Sizing Tip:

I've had a lot of people ask me about population sizing, especially people who are attempting large problems where 100 individuals is probably not enough. The true authority on the subject is David Goldberg, but here is a crude population scaling law in my paper (based on Goldberg & Deb, 1992):

npopsiz = order[(l/k)(2**k)] for binary coding

where l = nchrome and k is the average size of the schema of interest (effectively the average number of bits per parameter, i.e. approximately equal to nchrome/nparam, rounded to the nearest integer). I find that when I have uniform crossover and niching turned on (which I recommend doing), that this scaling law is usually overkill, i.e. you can most likely get by with populations at least twice as small.

Remember to make the parameter 'indmax' (in 'params.f') greater than or equal to 'npopsiz'.

##
########

Creep Mutation Probability Tip:

I generally like to have approximately the same number of creep mutations and jump mutations per generation. Using basic probabilistic arguments, it can be shown that you will get approximately the same number of creep and jump mutations when

pcreep = (nchrome/nparam) * pmutate

where pmutate (the jump mutation probability) is 1/npopsiz.

##
########

Suggested reading that I have found to be of use:

Goldberg, D. E., and Richardson, J., "Genetic Algorithms with Sharing for Multimodal Function Optimization," Genetic Algorithms and their Applications: Proceedings of the Second International Conference on Genetic Algorithms, 1987, pp. 41-49.

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##
#######

If you are interested in my work (which may give some insights into how and why I coded some aspects of my GA), I can mail copies of three papers of mine.

G. Yang, L.E. Reinstein, S. Pai, Z. Xu, and D.L. Carroll, "A new genetic algorithm technique in optimization of permanent 125-I prostate implants,"

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(A preprint version of this paper can now be downloaded in PDF format
via my website:
<http://www.staff.uiuc.edu/~carroll/gatips.html> look for AIAA1996.pdf)

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eds. H.B. Wilson, R.C. Batra, C.W. Bert, A.M.J. Davis, R.A. Schapery, D.S.
Stewart, and F.F. Swinson, School of Engineering, The University of Alabama,
1996, pp.411-424.
(This paper can now be downloaded in PDF format via my website:
<http://www.staff.uiuc.edu/~carroll/gatips.html> look for SECTAM18.pdf)

###
########

Disclaimer: this program is not guaranteed to be free of error
(although it is believed to be free of error), therefore it should
not be relied on for solving problems where an error could result in
injury or loss. If this code is used for such solutions, it is
entirely at the user's risk and the author disclaims all liability.

Appendix 3

Script of a session with the package

```
Script started on Sun Feb 18 00:19:40 2001
$ ⇒ inst

/tmp/ccxTYckW.o: In function `main':
/tmp/ccxTYckW.o(.text+0xa): the `gets' function is dangerous and should not be used.
/tmp/ccTojbTU.o: In function `main':
/tmp/ccTojbTU.o(.text+0xa): the `gets' function is dangerous and should not be used.
/tmp/cc7jo8an.o: In function `main':
/tmp/cc7jo8an.o(.text+0xa): the `gets' function is dangerous and should not be used.
$ ⇒ work
Give the hotmetal weight(Kgs) : 271900
Give the scrap weight(Kgs) : 52100
Give the hot metal manganese(wt%) : 0.352
Give the hot metal phosphorus(wt%) : 0.059
Give the hot metal silicon(wt%) : 0.556
Give the lime added during first blow(Kgs) : 11231
Give the dolomite added during first blow(Kgs) : 0
Give the return slag added in first blow(Kgs) : 3346
Give the temperature at sublance point (degree C) : 1561
Give the carbon at sublance point(wt%) : 0.441
Give aim temperature(degree C) : 1625
Give aim carbon(wt%) : 0.043
Give aim manganese(wt%) : 0.105
Give aim phosphorus(wt%) : 0.007
Give aim dissolved oxygen(ppm) : 618
######################The FIRST OPTION###############################



-----------------------------------------------------------------
     Suggested Operating Parameters
-----------------------------------------------------------------
 O22   lime2   dolo2   ore2  rslg2  rdl2  hlans2
```

2271.0	375.0	0.0	0.0	0.0	0.0	250.0

Composition Report

##

	predicted	target
Carbon	0.047	0.043
Dissolved Oxygen	768	618
Temperature	1645	1625
Mangnese	0.1357	0.1050
Phosphorus	0.0078	0.0070

##

The heat lies outside the window

cost is 243

########################The SECOND OPTION##################################

Suggested Operating Parameters

O22	lime2	dolo2	ore2	rslg2	rdl2	hlans2
2351.0	0.0	2000.0	0.0	0.0	1498.0	232.0

Composition Report

##

	predicted	target
Carbon	0.047	0.043
Dissolved Oxygen	646	618
Temperature	1625	1625
Mangnese	0.1034	0.1050
Phosphorus	0.0055	0.0070

##

The heat lies inside the window

cost is 16

######################The THIRD OPTION################################

Suggested Operating Parameters

O22	lime2	dolo2	ore2	rslg2	rdl2	hlans2
2231.0	270.0	0.0	943.0	1694.0	0.0	215.0

Composition Report

###

	predicted	target
Carbon	0.044	0.043
Dissolved Oxygen	623	618
Temperature	1625	1625
Mangnese	0.0981	0.1050
Phosphorus	0.0070	0.0070

###

The heat lies inside the window

cost is 11

######################THE BEST OPTION################################

Suggested Operating Parameters

O22	lime2	dolo2	ore2	rslg2	rdl2	hlans2
2231.0	270.0	0.0	943.0	1694.0	0.0	215.0

Composition Report

```
##########################################################
                predicted      target
##########################################################
Carbon                0.044       0.043
Dissolved Oxygen        623         618
Temperature            1625        1625
Mangnese             0.0981      0.1050
Phosphorus           0.0070      0.0070
##########################################################
The heat lies inside the window
cost is 11
$ exit


Script done on Sun Feb 18 00:24:40 2001
```

Composition Report

```
##########################################################
                  predicted     target
##########################################################
Carbon                0.044       0.043
Dissolved Oxygen        623         618
Temperature            1625        1625
Mangnese             0.0981      0.1050
Phosphorus           0.0070      0.0070
##########################################################
```

The heat lies inside the window

cost is 11

$ exit

Script done on Sun Feb 18 00:24:40 2001

Appendix 4
Data files

A4.1 Data set D1

```
Heatno Chargno date    Wbath   Gry  Gschrot C_ry Mn_ry P_ry Si_ry Lnslf
Lime1 dolm1 Ore1 Rslg1 Rdl1 T1    C1    Mn1    P1    O21    O22  lime2
dolm2 Ore2 Rslg2 Rdl2 Hlns2  T2   C2   Mn2    P2   Oact2
1739  20844  01 09 00 298800 271900  52000 4.587 0.352 0.059 0.556   225
11231     0 5422 3346    0  1561 0.441 0.264 0.027 11194  2240     0
0    0    0  1516   217  1625 0.043 0.105 0.007 618
1740  11945  01 09 00 316500 292700  48600 4.635 0.374 0.059 0.524   135
14918    0 6122 3711  485  1575 0.479 0.261 0.021 13066  2339     0
0    0    0   463   214  1659 0.046 0.132 0.009 877
1741  11946  01 09 00 334000 292300  60200 4.891 0.402 0.058 0.858   136
17951    0 11947 3855 3995  1600 0.283 0.255 0.014 13486  1781     0
0    0    0   729   221  1662 0.046 0.124 0.006 644
1743  11947  01 09 00 318600 274800  64900 4.910 0.399 0.058 0.833   137
14370    0 7923 3574 3993  1594 0.351 0.235 0.032 13072  1861     0
0    0    0   512   212  1656 0.056 0.140 0.011 631
1744  20846  01 09 00 332800 292100  59600 4.741 0.384 0.059 0.622     7
14500    0 7173 3430 1993  1627 0.225 0.308 0.026 13218  1475     0
0    0    0  1101   236  1654 0.060 0.209 0.013 352
1745  11948  01 09 00 318700 284600  56600 4.673 0.376 0.060 0.581   138
13884    0 6053 2644    0  1599 0.284 0.255 0.037 13034  1703     0
0    0    0   343   212  1666 0.045 0.141 0.014 865
1751  11952  01 09 00 323600 296900  44500 4.651 0.372 0.056 0.507   142
15089    0 7793 3664  577  1611 0.239 0.275 0.020 13359  1802     0
0    0    0    0   213  1685 0.040 0.149 0.010 886
1752  20849  01 09 00 335900 305500  47800 4.657 0.381 0.060 0.623    10
17708    0 6181 3931  956  1620 0.348 0.345 0.024 13631  1995     0
0   460    0    0   238  1690 0.050 0.184 0.011 579
1755  20852  01 09 00 325900 295800  59500 4.631 0.381 0.059 0.545    13
17506    0 1778 3918    0  1629 0.243 0.287 0.018 13836  1789     0
0    0    0    0   238  1703 0.042 0.152 0.009 524
1756  20853  01 09 00 321000 306800  35600 4.626 0.395 0.060 0.512    14
18096    0 6802 4032 1494  1627 0.256 0.277 0.020 13618  1564     0
0    0    0    0   235  1696 0.044 0.154 0.009 700
1760  11953  01 09 00 331300 305600  49000 4.756 0.398 0.060 0.559   143
16091    0 7103 3960  318  1598 0.347 0.287 0.030 13778  2186     0
1    0    0    0   225  1683 0.046 0.154 0.012 769
1763  11955  01 09 00 325400 291700  64000 4.603 0.406 0.062 0.894   145
18655    0 6951 5062    0  1588 0.362 0.261 0.009 13377  2008     0
0    0    0    92   210  1657 0.065 0.145 0.006 602
1766  20859  01 09 00 318500 290100  52000 4.705 0.344 0.054 0.418    20
11992    0 4396 2958    0  1599 0.540 0.330 0.037 11849  2099     0
0    0    0  1198   234  1650 0.084 0.212 0.016 266
1767  11957  01 09 00 319000 294000  50900 4.536 0.382 0.057 0.597   147
14302    0 4001 3543    0  1625 0.286 0.299 0.025 13563  1505     0
0    0    0   176   224  1671 0.052 0.193 0.015 720
1768  20860  02 09 00 314700 310700  41200 4.420 0.361 0.057 0.372    21
13181    0 1511 3085  607  1600 0.486 0.301 0.029 12470  2068     0
0    0    0   534   231  1670 0.053 0.193 0.013 451
```

1769 11958 02 09 00 328400 298700 59300 4.689 0.372 0.057 0.405 148
12143 0 2612 2961 0 1601 0.387 0.315 0.031 13593 2001 0
2002 0 0 0 214 1677 0.048 0.179 0.016 744
1770 20861 02 09 00 322400 305100 48000 4.625 0.369 0.057 0.487 22
16085 0 4396 3503 737 1596 0.427 0.303 0.029 12949 2117 0
0 0 0 1 233 1669 0.054 0.186 0.012 454
1771 11959 02 09 00 329800 296100 63700 4.741 0.384 0.057 0.643 149
16882 0 4114 4148 0 1616 0.208 0.287 0.025 14175 1510 0
0 0 0 0 220 1666 0.053 0.163 0.011 712
1777 11962 02 09 00 314600 283400 60200 4.689 0.378 0.056 0.569 152
13724 0 4392 3348 0 1597 0.427 0.264 0.031 13096 1929 0
2003 0 0 499 206 1656 0.059 0.160 0.013 513
1778 20865 02 09 00 308000 289000 52900 4.638 0.368 0.058 0.586 26
13516 0 4097 5481 485 1599 0.539 0.217 0.044 12386 2079 0
0 0 0 1027 229 1688 0.042 0.156 0.017 959
1780 20866 02 09 00 331500 297800 53900 4.734 0.397 0.060 0.653 27
16065 0 8602 4995 0 1601 0.370 0.300 0.031 12995 1840 0
0 0 0 475 240 1658 0.049 0.178 0.012 500
1783 11965 02 09 00 321700 280300 66900 4.779 0.387 0.059 0.565 155
13435 0 6427 3789 0 1579 0.343 0.281 0.018 12817 1950 0
1924 0 0 500 210 1639 0.051 0.141 0.008 803
1784 20868 02 09 00 320900 288800 53300 4.990 0.396 0.059 0.527 29
13591 0 8863 4571 359 1588 0.310 0.303 0.027 12363 1749 0
0 0 0 0 234 1648 0.049 0.172 0.011 585
1789 20872 02 09 00 331600 310100 49100 4.625 0.375 0.057 0.490 33
16564 0 2849 5071 1492 1615 0.217 0.252 0.014 13962 1689 0
0 0 0 0 240 1673 0.043 0.153 0.008 561
1790 20874 02 09 00 305000 296200 43900 4.593 0.387 0.059 0.534 35
16516 0 2493 3633 1085 1616 0.395 0.328 0.033 12512 1822 0
0 406 0 0 226 1674 0.066 0.204 0.014 447
1791 20873 02 09 00 331500 298100 62100 4.804 0.374 0.056 0.508 34
16199 0 2513 3559 1281 1622 0.295 0.276 0.020 13683 1718 0
0 218 0 49 239 1677 0.059 0.168 0.010 398
1792 20875 02 09 00 316800 303100 39100 4.647 0.388 0.057 0.525 36
15576 0 7464 3427 769 1605 0.440 0.309 0.026 12715 2018 0
0 0 0 0 233 1688 0.053 0.170 0.012 696
1793 20876 02 09 00 327700 295100 59800 4.625 0.381 0.056 0.476 37
13538 0 2011 3078 624 1608 0.380 0.283 0.030 13229 1756 0
0 0 0 0 244 1671 0.056 0.185 0.013 601
1794 20877 02 09 00 318700 301600 41600 4.546 0.367 0.057 0.418 38
12952 0 4213 3066 597 1622 0.335 0.312 0.031 12770 1638 0
0 0 0 810 239 1666 0.062 0.200 0.015 498
1795 11967 02 09 00 323900 292900 53700 4.529 0.352 0.057 0.324 157
10497 0 2117 5378 523 1600 0.423 0.310 0.029 13629 2287 0
1989 0 0 0 228 1683 0.041 0.153 0.017 962
1796 20878 02 09 00 294000 273700 40500 4.599 0.366 0.057 0.388 39
11202 0 6211 3828 417 1576 0.469 0.303 0.025 11008 2039 0
0 0 0 913 227 1639 0.064 0.174 0.012 568
1801 11973 03 09 00 327400 293100 58800 4.542 0.379 0.058 0.456 163
13616 0 0 3457 1132 1609 0.227 0.290 0.018 13774 2235 494
0 0 0 0 224 1688 0.048 0.144 0.010 1058
1803 11971 03 09 00 338200 294500 65500 4.558 0.364 0.056 0.367 161
11939 0 0 3039 842 1590 0.369 0.256 0.026 13738 2610 502
1267 0 0 0 220 1679 0.034 0.118 0.011 1165
1804 11972 03 09 00 335100 309000 46200 4.593 0.381 0.059 0.464 162
15004 0 3812 3776 1352 1626 0.148 0.227 0.011 14176 1750 498
0 0 0 0 229 1684 0.044 0.143 0.009 983

```
1806 11974 03 09 00 316600 308900 36700 4.587 0.375 0.058 0.488 164
16354 0 5008 4122 1504 1606 0.322 0.252 0.021 13266 2296 503
0 0 0 0 207 1687 0.045 0.130 0.009 875
1808 20883 03 09 00 325100 292500 56400 4.455 0.375 0.058 0.484 44
16643 0 0 3669 1338 1588 0.524 0.303 0.027 12978 2455 0
0 495 0 0 248 1664 0.053 0.177 0.010 721
1809 11975 03 09 00 328000 296500 58000 4.670 0.385 0.056 0.487 165
11936 0 2601 3003 0 1574 0.525 0.282 0.020 13202 2553 0
0 0 0 0 209 1668 0.052 0.139 0.011 916
1815 11978 03 09 00 324200 297100 54900 4.654 0.372 0.058 0.469 168
18094 0 2211 4422 1502 1614 0.226 0.252 0.022 14372 2000 0
0 0 0 0 215 1686 0.044 0.128 0.010 868
1827 20892 03 09 00 319600 298600 54900 4.635 0.360 0.057 0.505 55
14980 0 2316 3271 1113 1590 0.585 0.269 0.032 12690 2498 0
0 0 0 396 240 1676 0.067 0.167 0.013 792
1828 11985 03 09 00 295700 269600 47400 4.638 0.349 0.059 0.444 175
11172 0 6609 2804 314 1587 0.312 0.291 0.026 11636 1498 0
0 0 0 1200 187 1632 0.057 0.164 0.012 719
1830 11986 03 09 00 337200 296400 62800 4.843 0.339 0.056 0.370 176
12545 0 4316 3105 883 1624 0.147 0.262 0.032 13951 1388 0
0 387 0 0 208 1650 0.065 0.181 0.018 539
1832 11987 03 09 00 334300 309400 49500 4.776 0.344 0.058 0.499 177
17221 0 6704 4225 1396 1626 0.168 0.238 0.025 14050 1484 0
0 515 0 0 208 1670 0.047 0.141 0.012 735
1833 20895 03 09 00 327800 295700 53200 4.705 0.338 0.057 0.416 58
13719 0 3300 2984 1002 1638 0.262 0.264 0.027 13427 1899 0
928 0 0 1436 249 1691 0.048 0.128 0.010 796
1834 11988 03 09 00 321500 290000 53500 4.785 0.326 0.057 0.474 178
14956 0 5195 3659 1147 1609 0.303 0.279 0.032 13139 1807 0
0 187 0 1004 212 1680 0.054 0.151 0.013 916
1836 20896 03 09 00 323300 297800 47300 4.775 0.320 0.058 0.405 60
14815 0 6691 5144 1235 1584 0.438 0.267 0.029 12595 2138 0
0 915 0 33 247 1666 0.054 0.146 0.011 637
1837 11989 04 09 00 292700 267400 50600 4.654 0.327 0.058 0.411 179
10813 0 3999 2730 354 1561 0.549 0.228 0.028 11213 2350 0
0 951 104 0 190 1636 0.042 0.114 0.009 840
1838 11990 04 09 00 290700 273200 42000 4.632 0.328 0.058 0.496 180
14249 0 4303 3446 991 1594 0.323 0.245 0.028 12094 2358 0
0 0 0 0 189 1680 0.037 0.102 0.010 1224
1839 20898 04 09 00 320600 304100 38000 4.644 0.324 0.058 0.438 62
15172 0 5852 3313 1304 1610 0.453 0.272 0.030 12738 2245 0
0 0 0 654 239 1683 0.055 0.161 0.013 633
1840 20899 04 09 00 322900 297900 47000 4.673 0.328 0.057 0.435 63
14314 0 3401 3270 1164 1610 0.420 0.280 0.014 12954 2079 0
0 0 0 1002 239 1683 0.055 0.153 0.012 607
1841 11991 04 09 00 330400 290800 66400 4.705 0.323 0.056 0.441 181
13880 0 891 3479 451 1597 0.490 0.289 0.027 13538 2133 0
0 514 0 0 210 1659 0.058 0.169 0.011 555
1842 20900 04 09 00 326400 304300 47100 4.762 0.336 0.061 0.475 64
15703 0 5781 3443 1387 1639 0.279 0.294 0.032 13055 1794 0
0 0 554 1632 232 1665 0.063 0.172 0.012 623
1843 20901 04 09 00 329300 291100 62800 4.744 0.332 0.059 0.483 65
14294 0 2202 3282 1073 1627 0.364 0.299 0.026 13103 2075 0
0 0 0 1962 232 1667 0.063 0.177 0.012 536
1844 11992 04 09 00 323600 290100 60500 4.632 0.314 0.061 0.366 182
15151 0 476 3664 634 1572 0.510 0.252 0.030 13895 2541 0
0 0 0 0 214 1663 0.045 0.126 0.011 833
```

```
1845  11993  04 09 00 317500 308200  44500 4.436 0.303 0.057 0.337   183
11742     0 1406 2924  562  1605 0.277 0.245 0.025 13347  1798     0
0     0     0     0   210  1667 0.044 0.134 0.011 817
1846  11994  04 09 00 318500 298600  45600 4.586 0.320 0.057 0.421   184
12721     0 4486 3186  390  1597 0.362 0.263 0.020 13136  2124     0
0     0     0     0   211  1680 0.043 0.129 0.009 1011
1847  11995  04 09 00 321500 293400  48000 4.657 0.323 0.059 0.476   185
13525     0 5415 3350  340  1570 0.356 0.223 0.016 13045  2386     0
0     0     0     0   211  1663 0.046 0.099 0.009 1040
1848  11999  04 09 00 315400 290400  55900 4.660 0.324 0.061 0.526   189
14556     0 2482 3502  521  1599 0.297 0.246 0.022 13542  1847     0
0     0     0     0   211  1664 0.049 0.138 0.010 900
1851  11998  04 09 00 290000 278300  39100 4.497 0.309 0.063 0.370   188
10547     0 5298 2654  345  1565 0.464 0.234 0.017 11475  2087     0
0     0     0   521   197  1639 0.047 0.129 0.010 884
1852  12000  04 09 00 328300 297300  60100 4.574 0.318 0.060 0.380   190
11435     0 2317 2861    0  1593 0.313 0.257 0.019 13582  1785     0
0     0     0   194   217  1654 0.050 0.151 0.012 843
1853  12001  04 09 00 324900 297300  49500 4.744 0.311 0.057 0.424   191
12951     0 8571 3252    0  1589 0.339 0.255 0.029 13062  2160     0
0     0     0     0   202  1674 0.042 0.118 0.011 1104
1854  20902  04 09 00 309700 284700  54400 4.363 0.324 0.057 0.389    67
10256     0 1508 4733    0  1549 0.697 0.205 0.033 12419  3303     0
0     0     0   605   234  1677 0.033 0.091 0.012 1336
1858  20904  04 09 00 314200 290200  58300 4.264 0.311 0.057 0.344    69
11255     0    0 2761  305  1564 0.586 0.258 0.032 12594  3000     0
1481     0     0     0   213  1686 0.038 0.090 0.010 1320
1859  12004  04 09 00 319800 297800  46900 4.414 0.297 0.056 0.328   194
10320     0    0 2569    0  1612 0.374 0.293 0.026 13181  2350     0
0     0     0     0   206  1691 0.040 0.152 0.014 1098
1862  20907  04 09 00 320400 295300  47100 4.776 0.338 0.058 0.455    72
14626     0 7921 3228  640  1575 0.373 0.255 0.022 12937  2319     0
2002     0     0     0   249  1668 0.048 0.125 0.009 982
1863  20906  04 09 00 337100 285200  55800 4.734 0.333 0.058 0.441    71
11335     0 3611 2815    0  1610 0.193 0.257 0.020 12690  1884     0
1996     0     0  1412   237  1653 0.046 0.123 0.009 922
1864  12006  04 09 00 321400 287400  55600 4.536 0.325 0.060 0.505   196
12495     0 1805 3084    0  1614 0.201 0.256 0.017 13420  1799     0
0     0     0     0   206  1669 0.045 0.134 0.011 923
1865  12007  04 09 00 320000 281600  61000 4.600 0.367 0.064 0.907   197
17197     0 6699 4207    0  1613 0.127 0.218 0.013 13486  1687     0
0     0     0     0   227  1660 0.053 0.116 0.008 922
1866  20908  04 09 00 333800 286100  73400 4.741 0.371 0.062 0.901    73
19999     0 5514 4495    0  1599 0.214 0.250 0.016 13829  2139     0
1994     0     0     0   232  1679 0.047 0.116 0.007 985
1871  12010  05 09 00 316100 283200  63700 4.701 0.363 0.061 0.967   199
19996     0 5976 4917    0  1608 0.169 0.185 0.010 13755  1864     0
0     0     0     0   181  1661 0.043 0.102 0.005 891
1876  20913  05 09 00 333300 300500  57700 4.849 0.325 0.057 0.522    78
16689     0 6601 3683  900  1598 0.337 0.250 0.014 13403  2098     0
0     0     0   701   233  1667 0.052 0.129 0.007 624
1879  12014  05 09 00 313900 286000  56900 4.721 0.331 0.057 0.458     3
16333     0 1004 3620    0  1617 0.260 0.262 0.022 13626  1900     0
0     0     0     0   147  1679 0.044 0.135 0.010 1071
1881  20915  05 09 00 327600 293000  61700 4.670 0.338 0.058 0.517    80
15613     0  497 3409  628  1614 0.396 0.285 0.027 13647  1975     0
0     0     0  1504   229  1665 0.063 0.168 0.012 499
```

1882 20916 05 09 00 262900 284200 57000 4.689 0.326 0.057 0.479 81
15387 0 1588 3341 465 1614 0.359 0.277 0.025 12939 1800 0
0 0 0 1499 224 1654 0.063 0.162 0.010 416
1883 12016 05 09 00 317800 295200 53500 4.670 0.336 0.057 0.496 5
13981 0 3104 3444 469 1622 0.112 0.209 0.012 13440 1706 0
0 0 0 0 149 1684 0.039 0.095 0.007 1355
1886 20919 05 09 00 328300 294700 63100 4.597 0.328 0.058 0.584 84
17427 0 2017 3933 985 1610 0.182 0.213 0.010 13839 1575 0
0 965 1373 0 229 1636 0.057 0.121 0.005 427
1888 20920 05 09 00 326100 295700 44100 4.568 0.321 0.058 0.543 85
15561 0 7011 3405 539 1628 0.155 0.217 0.011 13086 1433 0
0 966 641 0 232 1650 0.066 0.135 0.006 409
1889 12018 05 09 00 323700 294000 54700 4.660 0.386 0.060 0.724 7
16112 0 1619 3957 931 1636 0.370 0.293 0.047 13788 1905 0
0 0 0 1378 152 1699 0.051 0.171 0.018 989
1890 20921 05 09 00 334900 294500 63600 4.718 0.379 0.060 0.841 86
20003 0 7398 4507 0 1608 0.257 0.274 0.020 13405 1798 0
0 578 0 0 233 1659 0.060 0.154 0.007 459
1891 12019 05 09 00 291400 251800 64300 4.795 0.368 0.061 0.821 8
15368 0 6489 3800 0 1586 0.332 0.233 0.035 11588 1810 0
0 916 2095 0 143 1634 0.041 0.106 0.012 990
1894 20924 05 09 00 325500 284800 72000 4.734 0.334 0.060 0.843 89
16655 0 5084 3715 0 1608 0.317 0.277 0.036 12869 1925 0
0 594 284 0 229 1671 0.045 0.138 0.010 720
1896 20926 05 09 00 315800 280300 62200 4.731 0.334 0.059 0.714 91
15971 0 6231 3491 0 1607 0.382 0.270 0.022 12445 2096 0
2003 0 0 551 224 1662 0.051 0.150 0.008 584
1897 12020 05 09 00 294300 260400 43600 4.615 0.312 0.059 0.892 9
15445 0 3914 2752 0 1581 0.131 0.124 0.020 12173 1670 0
0 0 0 0 150 1638 0.044 0.063 0.007 1141
1898 20927 05 09 00 328100 296900 53400 4.632 0.311 0.060 0.725 92
18407 0 7174 4115 334 1608 0.321 0.230 0.023 12919 2228 0
2003 0 0 528 228 1667 0.051 0.126 0.007 607
1900 20928 05 09 00 302400 271400 52800 4.619 0.314 0.059 0.546 93
10942 0 6318 3910 0 1551 0.612 0.230 0.021 11061 2592 0
2001 0 0 2518 216 1610 0.046 0.092 0.006 541
1903 12023 05 09 00 323800 297400 43400 4.759 0.349 0.061 0.675 12
19989 0 6925 4899 991 1648 0.162 0.228 0.017 14065 1725 0
0 0 0 0 150 1706 0.044 0.118 0.009 1364
1905 20931 05 09 00 325200 295000 62300 4.666 0.402 0.059 0.602 96
19058 0 1999 4292 1456 1570 0.497 0.227 0.008 13599 2369 0
2001 907 0 0 228 1647 0.060 0.123 0.004 364
1907 12025 05 09 00 320000 298000 50300 4.718 0.353 0.059 0.647 14
19997 0 2896 4915 1494 1632 0.251 0.294 0.038 14117 1955 0
0 0 0 0 200 1708 0.042 0.144 0.014 1069
1908 12026 05 09 00 320200 300500 46400 4.786 0.422 0.062 0.591 15
19027 0 5513 4671 1426 1635 0.269 0.320 0.030 13539 1603 0
0 0 0 9 163 1690 0.055 0.203 0.015 678
1909 20932 05 09 00 329400 296300 61200 4.647 0.338 0.059 0.612 97
19947 0 1586 4483 1477 1652 0.201 0.228 0.015 13821 1547 0
0 995 815 124 229 1678 0.060 0.144 0.008 406
1910 12027 05 09 00 323300 296000 52800 4.760 0.406 0.060 0.665 16
19316 0 4593 4757 1139 1639 0.270 0.291 0.026 13605 1601 0
0 0 0 258 164 1687 0.060 0.188 0.013 761
1912 12028 05 09 00 326700 299700 54600 4.600 0.344 0.061 0.641 17
18491 0 1798 4500 0 1612 0.393 0.266 0.038 13799 1806 0
0 0 0 584 166 1673 0.058 0.171 0.015 628

```
1913 20934 06 09 00 324800 294100 51300 4.798 0.382 0.059 0.518 99
18723 0 6422 4182 1495 1619 0.250 0.253 0.019 12983 1735 0
0 0 0 999 225 1652 0.055 0.137 0.007 445
1914 12029 06 09 00 335600 311600 51800 4.789 0.403 0.059 0.499 18
16093 0 4995 4246 1564 1633 0.328 0.320 0.037 13904 1798 0
0 0 0 1026 174 1677 0.060 0.201 0.018 714
1915 12030 06 09 00 322900 291200 54900 4.760 0.396 0.058 0.507 19
15315 0 4789 3717 670 1602 0.393 0.336 0.038 13065 1986 0
0 0 0 0 184 1675 0.053 0.187 0.016 968
1917 12031 06 09 00 336100 310200 46800 4.699 0.381 0.058 0.613 20
19491 0 6222 4880 2510 1611 0.343 0.239 0.026 14005 2239 499
0 0 0 1135 174 1670 0.053 0.131 0.010 657
1918 20936 06 09 00 318900 289200 54200 4.721 0.427 0.059 0.507 101
13737 0 4805 3050 346 1620 0.382 0.341 0.026 12954 1711 0
0 0 0 0 223 1691 0.050 0.200 0.012 495
1919 12032 06 09 00 325300 296000 49400 4.715 0.354 0.058 0.552 21
18073 0 4088 4537 994 1639 0.236 0.255 0.026 13715 1849 498
0 0 0 1192 168 1689 0.046 0.130 0.010 1037
1923 12034 06 09 00 332900 309300 50000 4.702 0.434 0.059 0.533 23
18602 0 5299 4684 1001 1611 0.414 0.300 0.025 13445 2476 496
0 0 0 1248 177 1671 0.050 0.158 0.010 761
1924 20939 06 09 00 316000 292600 44700 4.638 0.364 0.059 0.576 104
13235 0 9926 3070 0 1579 0.280 0.227 0.011 12020 1854 0
0 0 0 558 213 1629 0.058 0.152 0.007 388
1926 20940 06 09 00 332200 296700 60000 4.753 0.376 0.059 0.574 105
15754 0 5601 4085 0 1630 0.297 0.333 0.030 13332 1806 0
0 849 0 0 221 1675 0.050 0.181 0.011 450
1927 12036 06 09 00 319100 292100 51500 4.786 0.391 0.060 0.644 25
18023 0 10309 4889 3001 1557 0.418 0.220 0.012 12729 2421 0
0 0 0 131 173 1645 0.046 0.103 0.005 755
1929 12037 06 09 00 322300 283300 63900 4.711 0.445 0.060 0.574 26
16236 0 6946 3971 0 1570 0.340 0.302 0.020 12812 2076 0
0 0 0 482 174 1643 0.050 0.138 0.008 773
1931 12038 06 09 00 322700 280000 60700 4.718 0.391 0.060 0.726 27
15324 0 7041 3777 0 1603 0.313 0.289 0.035 12837 1963 0
0 0 0 112 173 1677 0.041 0.152 0.013 1057
1932 12039 06 09 00 331100 289800 67300 4.805 0.340 0.061 0.793 28
19261 0 7965 4651 0 1578 0.293 0.244 0.018 13543 1874 0
0 0 0 282 178 1647 0.042 0.109 0.008 982
1939 12044 06 09 00 327000 295400 54600 4.708 0.401 0.061 0.509 33
15071 0 7116 3679 701 1576 0.377 0.277 0.033 13114 2648 0
0 0 0 0 200 1666 0.042 0.130 0.010 953
1943 12045 06 09 00 323800 293800 55700 4.670 0.406 0.059 0.635 34
15134 0 5216 3426 426 1582 0.325 0.286 0.020 12974 2472 0
0 0 0 0 220 1669 0.038 0.124 0.008 976
1944 20948 06 09 00 319300 304800 40000 4.670 0.433 0.059 0.419 7
14577 0 6319 3270 1087 1617 0.274 0.338 0.035 12868 2056 0
0 0 0 0 217 1696 0.037 0.159 0.013 966
1945 12046 06 09 00 318200 294800 52400 4.558 0.386 0.059 0.470 35
13939 0 1200 3214 369 1590 0.464 0.348 0.029 12929 2826 0
0 0 0 640 199 1689 0.034 0.144 0.013 1226
1948 20950 06 09 00 318000 295000 41300 4.728 0.422 0.057 0.412 9
14008 0 5310 3058 1117 1619 0.291 0.337 0.038 12739 1822 0
0 0 0 709 215 1688 0.044 0.173 0.014 778
1949 12048 06 09 00 324300 295300 51700 4.615 0.415 0.061 0.626 37
19409 0 4015 4480 926 1610 0.268 0.316 0.031 13931 1737 0
0 0 0 336 174 1667 0.056 0.166 0.012 802
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1953  12050  06 09 00 346700 309200  54300 4.577 0.410 0.059 0.494    39
12111     0 7307 3005     0  1575 0.360 0.269 0.033 13327  2084     0
0    0    0    17   182   1648 0.043 0.166 0.017 816
1955  12051  06 09 00 323500 288200  57200 4.702 0.434 0.058 0.456    40
12510     0 6785 3137     0  1583 0.303 0.312 0.025 12844  2086     0
0    0    0     0   174   1650 0.043 0.160 0.011 817
1957  12052  07 09 00 318300 282400  57800 4.712 0.447 0.059 0.464    41
12550     0 7095 3100     0  1589 0.274 0.334 0.034 12864  1990     0
0    0    0     0   187   1667 0.040 0.146 0.014 1135
1961  12054  07 09 00 335200 298300  57000 4.664 0.464 0.066 0.456    43
15478     0 3514 3689 1307  1621 0.176 0.313 0.030 14185  1763   496
0    0    0   696   180   1671 0.041 0.154 0.014 1048
1963  12055  07 09 00 326500 296000  48900 4.721 0.415 0.061 0.391    44
13205     0 6789 3372 1061  1585 0.357 0.284 0.034 13092  2278   491
0    0    0   554   176   1650 0.039 0.127 0.014 1006
1968  12058  07 09 00 336100 308000  53600 4.705 0.439 0.058 0.497     2
19062     0 4707 4668 1492  1621 0.269 0.317 0.024 14698  1753     0
0    0    0   393   224   1685 0.046 0.175 0.012 977
1970  12059  07 09 00 319700 294000  51100 4.676 0.432 0.060 0.415     3
15130     0 4393 3692  878  1599 0.284 0.324 0.028 13543  1961     0
0    0    0     0   199   1680 0.052 0.162 0.012 939
1971  20961  07 09 00 321900 302100  40700 4.616 0.407 0.059 0.437    21
12481     0 5961 3063     0  1635 0.229 0.325 0.036 12761  1715     0
0    0    0     0   209   1691 0.052 0.193 0.016 655
1974  12061  07 09 00 322000 306700  40900 4.686 0.420 0.060 0.578     5
20012     0 6886 5079 1450  1627 0.169 0.253 0.018 14124  1420     0
0    0    0     0   225   1679 0.051 0.147 0.010 932
1976  12062  07 09 00 321000 293000  48500 4.738 0.429 0.059 0.661     6
20010     0 6902 4957 1124  1623 0.248 0.291 0.022 13871  1506     0
0    0    0   535   219   1671 0.067 0.184 0.012 887
1977  20964  07 09 00 337800 310300  44100 4.654 0.443 0.057 0.279    24
9281    0 3405 6228    0  1635 0.328 0.399 0.037 13009  1855     0     0
0    0   722   217  1680 0.061 0.270 0.022 364
1978  12063  07 09 00 321600 297900  52300 4.673 0.413 0.058 0.390     7
15062     0 2200 3467 1278  1622 0.435 0.346 0.037 13869  1909     0
0    0    0   397   200   1690 0.053 0.213 0.017 921
1979  20965  07 09 00 322500 295200  44500 4.705 0.435 0.061 0.409    25
10405     0 6109 4844     0  1620 0.423 0.368 0.036 12566  2126     0
0    0    0     0   204   1698 0.044 0.208 0.014 501
1982  12065  07 09 00 318100 295400  52500 4.686 0.431 0.057 0.427     9
16421     0 3010 4147 1500  1611 0.301 0.318 0.032 13881  1717     0
0    0    0     0   197   1671 0.056 0.201 0.015 672
1983  20967  07 09 00 317800 310000  37000 4.696 0.456 0.060 0.482    27
17842     0 6211 3992 1372  1631 0.340 0.331 0.029 13230  1724     0
0    0    0     1   207   1697 0.057 0.202 0.013 398
1984  12066  07 09 00 327400 296100  53300 4.795 0.410 0.057 0.544    10
19581     0 6005 4751 1343  1616 0.272 0.275 0.017 14198  1831     0
0  293    0     0   201   1681 0.046 0.155 0.008 737
1987  20969  07 09 00 333400 296200  61900 4.871 0.443 0.058 0.640     1
20041     0 5889 4476  843  1602 0.417 0.311 0.017 13533  2297     0
0    0    0     0   215   1672 0.060 0.176 0.008 452
1989  12069  07 09 00 264100 274900  42700 4.673 0.448 0.060 0.582    13
14426     0 8903 3236 2003  1516 0.787 0.250 0.011 10398  3418     0
0    0    0  2196   168   1628 0.043 0.087 0.004 868
1991  20971  07 09 00 324200 295400  52200 4.689 0.423 0.059 0.518     3
16971     0 2983 3889     0  1637 0.334 0.344 0.032 13236  2046     0
0    0    0  1543   211   1695 0.047 0.177 0.011 715
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1993  12070  07 09 00 302000 269600  51700 4.625 0.402 0.056 0.389    14
10879     0 6739 2668  262  1537 0.499 0.255 0.016 11800  2502     0
0    0    0     0   187  1635 0.044 0.117 0.008 957
1996  20974  07 09 00 339000 309100  54300 4.686 0.408 0.055 0.383     6
15517     0 3003 3046  506  1635 0.321 0.338 0.036 13338  2030     0
0  870  1635     0   223  1676 0.061 0.198 0.012 529
1997  12072  07 09 00 323000 294100  55800 4.654 0.412 0.056 0.441    16
17113     0 1611 3194    0  1626 0.247 0.317 0.030 14114  1695     0
0    0    0     0   202  1685 0.039 0.165 0.012 1077
1998  20975  07 09 00 325600 295000  52400 4.654 0.407 0.057 0.379     7
15321     0 1511 3356 1315  1603 0.470 0.330 0.036 13413  2298     0
0  677    0     0   217  1672 0.057 0.186 0.012 416
2005  20979  08 09 00 324700 294200  55900 4.600 0.389 0.057 0.389    11
15466     0 2531 3393   80  1612 0.264 0.286 0.018 13363  1796     0
0  736    0     0   217  1659 0.053 0.163 0.007 420
2006  12076  08 09 00 328600 296000  56100 4.814 0.415 0.058 0.424    20
17826     0 6203 4354 1499  1594 0.163 0.241 0.013 14224  2348     0
0    0    0     0   207  1689 0.035 0.095 0.007 1371
2007  20980  08 09 00 323400 300300  44700 4.683 0.400 0.056 0.387    12
14780     0 6003 3271 1229  1621 0.179 0.262 0.016 12846  1723     0
0  795    0     0   218  1670 0.050 0.154 0.008 588
2008  12077  08 09 00 324100 294000  52700 4.730 0.400 0.056 0.488    21
18227     0 5191 4471 1485  1617 0.141 0.235 0.012 13942  1803     0
0  610    0     0   205  1669 0.037 0.120 0.007 1076
2009  20981  08 09 00 321800 296100  46000 4.734 0.403 0.059 0.548    13
19064     0 6569 4280 1492  1637 0.229 0.278 0.018 13191  1763     0
0  912  1590     0   217  1675 0.052 0.153 0.008 503
2011  20982  08 09 00 322100 294100  51300 4.676 0.420 0.058 0.371    14
12698     0 4141 3090  897  1604 0.432 0.344 0.030 12503  2273     0
0  825  1010     0   219  1677 0.044 0.163 0.011 734
2015  12080  08 09 00 330100 295100  59800 4.507 0.382 0.058 0.476    24
16304     0    0 1380    0  1602 0.464 0.321 0.051 13934  2324     0
0  846   211     0   202  1680 0.035 0.159 0.016 1224
2016  12081  08 09 00 325700 308200  40200 4.510 0.352 0.056 0.319    25
13716     0 3483 2183 1081  1601 0.252 0.267 0.024 13846  1855     0
0    0    0     0   199  1661 0.046 0.151 0.011 942
2017  20985  08 09 00 323700 293100  51800 4.616 0.408 0.063 0.484    17
15633     0 5006 3439  551  1593 0.508 0.332 0.025 12867  2703     0
0  954   547     0   224  1682 0.040 0.138 0.008 941
2019  20986  08 09 00 335600 299800  55100 4.699 0.403 0.058 0.528    18
16797     0 7514 3322  628  1582 0.493 0.352 0.022 12811  2553     0
0  935   580     0   229  1662 0.046 0.156 0.007 671
2021  20987  08 09 00 327700 295600  51700 4.786 0.390 0.056 0.334    19
13980     0 7117 3074    0  1608 0.255 0.331 0.022 12894  1714     0
0  973   306     0   225  1653 0.065 0.173 0.009 537
2023  20988  08 09 00 327900 292900  54500 4.689 0.402 0.061 0.542    20
15044     0 8282 3294    0  1577 0.323 0.288 0.016 12774  2361     0
0    0    0     0   226  1662 0.044 0.146 0.007 560
2025  20989  08 09 00 325700 295200  52900 4.775 0.401 0.056 0.331    21
12980     0 7425 4072    0  1596 0.253 0.301 0.018 12637  1962     0
0    0    0     0   226  1660 0.050 0.169 0.009 529
2026  20990  08 09 00 325200 293700  55400 4.667 0.410 0.059 0.483    22
15710     0 3010 4509    0  1620 0.351 0.341 0.027 13398  1811     0
0  115    0     0   225  1674 0.051 0.189 0.011 466
2028  20991  08 09 00 321000 304000  38100 4.763 0.407 0.057 0.388    23
16117     0 6593 3598 1179  1635 0.281 0.334 0.026 12936  1736     0
0    0    0     0   230  1694 0.060 0.205 0.014 493
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2029 20993 08 09 00 327000 293500 52000 4.734 0.399 0.057 0.445 25
13077 0 7116 3563 313 1573 0.488 0.288 0.019 12459 2562 0
0 0 0 0 229 1664 0.055 0.156 0.008 523
2030 12086 08 09 00 332900 289700 71900 4.638 0.391 0.057 0.438 30
15533 0 997 3289 970 1559 0.479 0.281 0.022 13662 2779 0
0 0 0 0 220 1661 0.040 0.126 0.008 1068
2037 20998 08 09 00 334700 295100 58500 4.628 0.379 0.054 0.329 30
11019 0 2895 3641 0 1602 0.318 0.324 0.032 13067 1891 0
0 214 0 0 238 1663 0.048 0.196 0.014 519
2039 21000 08 09 00 327300 295200 47800 4.558 0.388 0.055 0.366 32
11579 0 4516 3273 0 1623 0.353 0.320 0.029 12763 1856 0
0 0 0 1039 234 1658 0.064 0.204 0.013 379
2043 21002 08 09 00 325500 292900 52000 4.696 0.395 0.055 0.364 34
11022 0 5585 2731 0 1595 0.224 0.289 0.015 12488 1995 0
0 0 0 0 232 1658 0.048 0.157 0.008 602
2045 21003 08 09 00 328300 301700 56400 4.705 0.412 0.058 0.446 35
10443 0 7015 2575 0 1598 0.261 0.310 0.023 12422 2048 0
0 0 0 0 230 1674 0.037 0.145 0.011 737
2048 21005 09 09 00 319700 294100 43900 4.482 0.404 0.057 0.356 37
12196 0 4297 2980 286 1622 0.190 0.294 0.020 12935 1702 0
0 354 0 0 221 1676 0.044 0.174 0.011 728
2052 21007 09 09 00 326100 292200 48600 4.555 0.400 0.058 0.432 39
13179 0 4413 3075 0 1631 0.208 0.332 0.023 12995 1644 0
0 961 544 0 222 1666 0.052 0.170 0.009 524
2057 12097 09 09 00 329000 293800 59400 4.651 0.404 0.056 0.445 41
16253 0 512 3991 1256 1634 0.138 0.280 0.019 14541 1500 0
0 0 0 690 203 1671 0.049 0.172 0.011 794
2058 21010 09 09 00 327500 307000 43000 4.641 0.392 0.057 0.381 42
15379 0 5807 3336 406 1606 0.281 0.287 0.021 13096 1786 0
0 0 0 1359 228 1635 0.047 0.139 0.006 467
2059 12098 09 09 00 320300 295000 54900 4.574 0.396 0.061 0.442 42
16316 0 0 3973 1372 1610 0.185 0.262 0.021 14399 2053 0
0 0 0 0 200 1675 0.045 0.135 0.010 1023
2064 21012 09 09 00 305900 292100 35300 4.520 0.377 0.065 0.356 44
14012 0 4508 3055 1087 1594 0.512 0.295 0.027 11911 2250 0
0 0 0 1973 215 1660 0.033 0.134 0.010 802
2065 12102 09 09 00 323000 306800 41400 4.603 0.383 0.057 0.400 46
16291 0 4191 4018 1492 1613 0.270 0.275 0.021 13815 1697 0
0 0 0 0 202 1668 0.054 0.165 0.011 647
2067 12103 09 09 00 333000 291400 66600 4.727 0.418 0.058 0.696 47
19857 0 3106 4615 975 1626 0.160 0.284 0.029 14586 1537 0
0 0 0 0 214 1675 0.041 0.160 0.013 890
2069 21015 09 09 00 321500 292000 55300 4.708 0.403 0.057 0.738 47
18678 0 7950 4158 551 1597 0.242 0.243 0.011 13364 2423 0
0 0 0 0 224 1698 0.038 0.099 0.005 890
2072 12106 09 09 00 306100 270200 52500 4.744 0.421 0.057 0.556 50
13382 0 8639 3328 0 1572 0.316 0.280 0.017 11926 1900 0
0 0 0 1397 194 1625 0.051 0.134 0.007 825
2073 12107 09 09 00 327400 291600 58700 4.750 0.415 0.059 0.587 51
18591 0 1118 4542 1499 1665 0.146 0.341 0.036 14497 1207 0
0 0 0 529 203 1691 0.071 0.262 0.023 562
2075 21016 09 09 00 300300 254900 60200 4.708 0.417 0.058 0.622 48
11971 0 7097 2969 0 1578 0.522 0.342 0.027 10954 2558 0
0 948 0 2337 213 1641 0.045 0.112 0.008 782
2078 21018 09 09 00 328100 288200 58900 4.779 0.433 0.057 0.500 50
15541 0 6202 3410 955 1604 0.369 0.330 0.024 13264 2371 0
0 882 0 0 230 1694 0.047 0.142 0.009 621

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2079  12110  09 09 00 318800 292900  51300 4.580 0.420 0.057 0.487    54
16431    0 1695 3034    0  1602 0.415 0.330 0.039 13210  1709     0
0   311     0     0   197  1679 0.055 0.212 0.016 788
2081  21020  09 09 00 322500 289900  53000 4.776 0.435 0.058 0.597    52
16814    0 8235 3731  919  1613 0.278 0.306 0.019 13027  2041     0
0   763     0     0   215  1691 0.044 0.139 0.008 753
2083  12112  09 09 00 301800 270700  52500 4.638 0.450 0.063 0.531    56
13145    0 6490 3183    0  1584 0.420 0.323 0.018 11779  1999     0
0     0     0  1631   195  1637 0.059 0.163 0.010 669
2084  12113  09 09 00 327100 307900  41700 4.660 0.406 0.057 0.494    57
18985    0 6997 4623    0  1617 0.201 0.249 0.013 13996  1604     0
0   511     0     0   209  1672 0.060 0.147 0.008 872
2085  21021  09 09 00 331500 290200  63000 4.772 0.443 0.060 0.838    28
20015    0 8739 4487    0  1571 0.331 0.268 0.009 13484  2328     0
0     0     0     0   222  1648 0.048 0.126 0.004 577
2086  12114  09 09 00 297800 250000  66100 4.833 0.437 0.059 0.752    58
14856    0 8740 4118    0  1560 0.328 0.249 0.011 11649  2102     0
0     0     0   325   199  1624 0.055 0.115 0.006 818
2088  12115  09 09 00 324500 290700  58000 4.657 0.452 0.065 0.640    59
19982    0 3422 4922    0  1619 0.312 0.339 0.030 13951  1689     0
0     0     0     0   212  1677 0.050 0.203 0.013 809
2089  21023  09 09 00 321800 288000  56500 4.619 0.442 0.059 0.470    30
14606    0 1932 3274  957  1633 0.289 0.365 0.031 13238  1668     0
0   916     0    47   213  1685 0.053 0.200 0.010 507
2090  21024  09 09 00 323600 300000  41500 4.529 0.432 0.057 0.465    31
14114    0 5996 3101    0  1614 0.431 0.355 0.035 12505  2070     0
0   958     0     0   212  1681 0.054 0.214 0.012 465
2092  12117  09 09 00 320700 288200  58300 4.674 0.455 0.062 0.527    61
18042    0 2203 4423 1487  1609 0.333 0.328 0.022 13802  1748     0
0   519     0     0   209  1676 0.048 0.172 0.010 814
2093  21025  09 09 00 328200 291300  56400 4.706 0.442 0.060 0.570    32
15727    0 5795 3452    0  1631 0.329 0.367 0.037 12791  1899     0
0   966     0  1003   218  1673 0.047 0.194 0.010 401
2095  21026  09 09 00 326500 282100  61800 4.660 0.452 0.058 0.560    33
14478    0 4409 3274  428  1619 0.230 0.360 0.035 12882  1758     0
0   940   887     0   214  1661 0.049 0.194 0.010 504
2096  12119  10 09 00 325500 284000  59400 4.734 0.435 0.056 0.450    63
12729    0 5303 3152    0  1608 0.361 0.348 0.027 13082  1998     0
0     0     0     0   210  1676 0.050 0.195 0.015 897
2097  21027  10 09 00 321300 279800  60400 4.728 0.447 0.061 0.537    34
11648    0 6930 2882    0  1602 0.351 0.377 0.031 12227  2295     0
0     0     0   518   212  1682 0.038 0.180 0.010 664
2098  12120  10 09 00 310300 269200  56600 4.667 0.456 0.058 0.506    64
12475    0 6997 3083  326  1566 0.421 0.344 0.015 11831  2089     0
0     0     0  1003   201  1633 0.056 0.181 0.008 622
2102  12122  10 09 00 329800 284000  64700 4.705 0.461 0.056 0.551    66
13172    0 5903 3270    0  1595 0.408 0.381 0.020 13191  2260     0
0     0     0   562   209  1661 0.046 0.174 0.011 843
2103  12123  10 09 00 301800 276100  44400 4.677 0.447 0.057 0.445    67
11828    0 7741 2886  320  1578 0.438 0.294 0.013 11698  2052     0
0     0     0  2006   196  1641 0.049 0.141 0.008 793
2104  21030  10 09 00 327300 281100  69400 4.778 0.451 0.056 0.643    37
14989    0 4642 3308    0  1615 0.362 0.362 0.027 12490  2217     0
0     0     0  1298   215  1658 0.054 0.187 0.009 417
2106  12124  10 09 00 322800 280900  69100 4.711 0.432 0.056 0.528    68
13778    0 3793 3417    0  1581 0.316 0.308 0.020 13262  2565     0
0     0     0     0   210  1676 0.040 0.117 0.008 1169
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2108  12125  10 09 00 329500 283100  72300 4.689 0.429 0.055 0.387    69
11886     0 1316 2939    0  1597 0.434 0.354 0.028 13423  2038     0
0    0     0     0   209  1672 0.049 0.220 0.017 858
2109  21033  10 09 00 319100 291100  57200 4.638 0.443 0.054 0.363    40
15000     0  899     0 3973  1618 0.329 0.297 0.035 13018  2268     0
0  626     0     0   234  1684 0.048 0.158 0.011 674
2113  21035  10 09 00 325200 304900  42400 4.692 0.430 0.055 0.327    42
16512     0 6081 1543 1997  1634 0.248 0.282 0.025 13145  1913     0
0  943  2521     0   212  1669 0.043 0.144 0.008 680
2114  12128  10 09 00 325900 283000  66300 4.759 0.433 0.054 0.347    72
11181     0 3598 2763    0  1586 0.249 0.311 0.016 13133  1900     0
0    0     0     0   204  1658 0.042 0.153 0.009 835
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15141     0 5710 3297 1287  1621 0.253 0.252 0.021 13019  1653     0
0   812     0      0   211  1661 0.053 0.141 0.009 519
2534  21241  22 09 00 324500 301800  42600 4.664 0.380 0.054 0.281   128
9726    0 4628 2501 1003  1603 0.400 0.289 0.029 12729  2647   501     0
0     0     0   203  1699 0.035 0.128 0.012 1290
2536  21242  23 09 00 296400 262800  55000 4.699 0.401 0.057 0.516   129
11595     0 5646 4658    0  1564 0.443 0.322 0.018 11107  2149     0
0   313  2443      0   189  1629 0.046 0.130 0.006 840
2545  21247  23 09 00 329100 285400  67900 4.843 0.410 0.058 0.673   134
16131     0 5592 4400    0  1584 0.437 0.312 0.022 12934  2385     0
0   421     0   144   200  1649 0.052 0.154 0.008 687
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A4.2 Data set D2

```
Heatno Chargno date    Wbath   Gry  Gschrot C_ry Mn_ry P_ry Si_ry Lnslf
Lime1 dolm1 Ore1 Rslg1 Rdl1 T1    C1    Mn1    P1    O21    O22   lime2
dolm2 Ore2 Rslg2 Rdl2 Hlns2  T2    C2  Mn2   P2   Oact2
```

```
2551  21249  23 09 00 306200 273200  50200 4.616 0.392 0.059 0.513   136
11354     0 7051 2809    0  1582 0.447 0.334 0.027 11411  1870     0
0   865  2510     4   187  1633 0.048 0.156 0.009 589
2553  21250  23 09 00 318700 294800  50800 4.446 0.331 0.059 0.629   137
12043     0 1797 2953    0  1647 0.143 0.291 0.034 13688  1451     0
0    0     0      0   191  1695 0.047 0.164 0.015 756
2555  21251  23 09 00 320900 294400  48900 4.545 0.371 0.055 0.282   138
11557     0 3535 2827    0  1606 0.295 0.322 0.023 12950  1836     0
0    0     0      0   195  1679 0.043 0.180 0.012 686
2561  21254  23 09 00 321200 294400  52000 4.590 0.347 0.056 0.528   141
15180     0 2600 3331    0  1609 0.392 0.303 0.039 12985  1813     0
0   807    0    427   192  1661 0.050 0.153 0.010 564
2563  21255  23 09 00 320700 308200  34600 4.539 0.384 0.058 0.453   142
15156     0 6804 2585    0  1611 0.382 0.299 0.025 12647  1811     0
0   600    0      0   192  1662 0.053 0.174 0.009 445
2565  21256  23 09 00 332600 294200  61600 4.619 0.397 0.057 0.493   143
15524     0 1842 2775    0  1637 0.346 0.346 0.029 13401  1854     0
0   948    0    484   196  1671 0.062 0.198 0.010 407
2571  21259  23 09 00 321800 293100  50400 4.642 0.383 0.057 0.452   146
15993     0  912 3529 1410  1655 0.217 0.307 0.040 13255  1741     0
0   758    0      0   189  1691 0.045 0.173 0.013 570
2573  21260  23 09 00 323300 294000  47400 4.650 0.344 0.056 0.376   147
14010     0 2915 3348 1106  1638 0.232 0.283 0.034 12792  1967     0
0  1006    0      0   190  1687 0.044 0.144 0.010 560
2581  21264  24 09 00 320700 296500  47000 4.667 0.368 0.055 0.367   151
10385     0 5425 6295    0  1608 0.390 0.322 0.027 12107  2659     0
0    0     0      0   190  1698 0.036 0.150 0.012 941
2583  21265  24 09 00 318800 293200  49500 4.606 0.340 0.053 0.255   152
9036     0     0 6122  313  1598 0.578 0.348 0.048 11999  3041     0     0
0    0   317    189  1711 0.038 0.168 0.015 906
2585  21266  24 09 00 329400 293300  56600 4.798 0.374 0.052 0.293   153
10764     0 3470 6278    0  1626 0.260 0.370 0.030 12797  1921     0
0    0     0      0   191  1695 0.035 0.206 0.015 685
2587  21267  24 09 00 319200 295900  45500 4.632 0.383 0.055 0.367   154
10411     0 5238 5627    0  1606 0.404 0.334 0.032 12175  2187     0
0    0     0      0   183  1684 0.046 0.181 0.015 612
2593  21270  24 09 00 320500 303300  48600 4.728 0.374 0.054 0.368   157
12565     0 4173 3077  663  1607 0.533 0.321 0.027 12271  1917     0
0   792  2570     0   181  1658 0.066 0.195 0.011 329
2603  21275  24 09 00 312700 288600  53200 4.760 0.378 0.058 0.410   162
14501     0 4665 3287  999  1598 0.405 0.304 0.024 12430  2491     0
0    0     0      0   181  1683 0.045 0.146 0.008 472
2605  21276  24 09 00 318700 286800  58500 4.766 0.392 0.057 0.433   163
15011     0 2980 3345  982  1613 0.396 0.339 0.031 12790  2264     0
0    0   779      0   182  1688 0.050 0.186 0.011 458
2607  21277  24 09 00 325100 293100  57500 4.714 0.391 0.057 0.459   164
15339     0 2317 3262 1020  1644 0.208 0.297 0.024 13730  1508     0
0    0     0    745   185  1679 0.064 0.195 0.013 427
2618  21281  24 09 00 315500 292500  50400 4.622 0.390 0.057 0.383   168
14850     0 1676 3258 1260  1583 0.696 0.322 0.034 12491  2546     0
0  1525    0     90   178  1646 0.087 0.200 0.013 288
2625  21284  25 09 00 320800 289500  54900 4.727 0.362 0.056 0.373   171
12771     0 2423    2  911  1645 0.296 0.311 0.028 12851  1797     0
0    4     0      0   179  1700 0.047 0.205 0.016 570
2629  21286  25 09 00 318600 306100  42100 4.606 0.367 0.057 0.360   173
16770     0 2705 3532 1443  1624 0.302 0.293 0.030 12997  1821     0
0   880  2039     0   179  1665 0.048 0.158 0.010 459
```

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2633  21288  25 09 00 323900 292300  54600 4.632 0.391 0.055 0.355   175
15533    0 3074 3105 1155  1611 0.316 0.319 0.024 13387  1982     0
0   779     0     0   183  1675 0.042 0.149 0.008 517
2639  21291  25 09 00 336700 292700  65700 4.728 0.402 0.056 0.434     1
14998    0 4356 3275  962  1596 0.266 0.290 0.015 13648  2150     0
0   460     0   123   189  1673 0.041 0.118 0.006 546
2640  21292  25 09 00 317600 291200  53400 4.702 0.391 0.057 0.405     2
12680    0 6525 5158    0  1574 0.556 0.308 0.031 11974  2640     0
0   735     0     0   147  1654 0.049 0.168 0.009 491
2642  21293  25 09 00 324800 291000  54100 4.625 0.359 0.060 0.341     3
11607    0 4724 2882    0  1597 0.399 0.294 0.051 12232  2343     0
0     0     0     0   148  1676 0.037 0.159 0.015 625
2645  21295  25 09 00 294200 266100  50500 4.670 0.353 0.057 0.294     5
9135    0 8440 6136    0  1525 0.470 0.231 0.016 10527  2593     0     0
0     0   536   136  1618 0.044 0.101 0.005 609
2657  21300  25 09 00 298100 256800  60000 4.674 0.372 0.057 0.419    10
9099    0 4672 6116    0  1572 0.209 0.230 0.015 11657  1968     0     0
997     0  1000   140  1633 0.035 0.075 0.005 735
2665  21304  25 09 00 324500 286400  60200 4.814 0.378 0.056 0.634    14
16349    0 5895 3576    0  1628 0.186 0.276 0.028 13197  1643     0
0     0     0     0   161  1677 0.041 0.161 0.011 675
2669  21306  25 09 00 324800 288800  57800 4.782 0.380 0.056 0.584    16
17386    0 5497 3901    0  1633 0.247 0.296 0.032 13092  1896     0
0     0     0   761   150  1682 0.039 0.158 0.011 655
2673  21309  26 09 00 322300 291500  54000 4.670 0.384 0.056 0.549    19
16017    0 3508 3521  459  1606 0.457 0.338 0.039 12849  2194     0
0   204     0     0   148  1677 0.047 0.207 0.014 445
2676  21310  26 09 00 322900 291700  52200 4.542 0.355 0.055 0.408    20
11699    0 4217 3079    0  1583 0.511 0.323 0.037 12247  1944     0
0     0     0    98   145  1646 0.071 0.233 0.017 300
2679  21312  26 09 00 322100 290500  56700 4.670 0.366 0.057 0.423    22
15010    0 3489 3285  809  1598 0.378 0.306 0.037 13101  2011     0
0     0     0   386   149  1666 0.046 0.172 0.012 456
2683  21314  26 09 00 322800 290500  60200 4.670 0.382 0.057 0.422    24
13960    0  893 3085  756  1619 0.359 0.358 0.043 13198  1847     0
0   612     0     0   153  1671 0.052 0.217 0.014 413
2684  21315  26 09 00 317600 299200  43600 4.670 0.373 0.056 0.528    25
18496    0 4249 3084 1224  1599 0.444 0.270 0.030 13225  2201     0
0     0     0     0   153  1672 0.052 0.156 0.010 485
2689  21320  26 09 00 299800 278100  43600 4.555 0.362 0.058 0.363    30
9555    0 6565 6457    0  1566 0.407 0.277 0.029 11408  2393     0     0
0     0  2276   142  1626 0.034 0.100 0.007 649
2694  21323  26 09 00 330000 305200  47000 4.548 0.373 0.057 0.387    33
12619    0 2189 3089  751  1636 0.315 0.302 0.042 13244  1895     0
0     0     0   693   156  1679 0.041 0.186 0.015 491
2698  21325  26 09 00 321900 288200  56100 4.571 0.387 0.059 0.511    35
13990    0 2099 3073    0  1625 0.269 0.292 0.041 13000  1862     0
0   500     0   601   145  1671 0.038 0.145 0.011 530
2705  21328  26 09 00 321400 289300  53500 4.840 0.373 0.056 0.442    38
14034    0 4223 3171 1002  1628 0.349 0.294 0.034 12913  2019   502
0     0     0   526   145  1676 0.043 0.162 0.012 480
2711  21331  27 09 00 325900 289100  57300 4.727 0.377 0.056 0.410    41
12258    0 6893 3014    0  1610 0.248 0.271 0.029 13209  1796     0
0     0     0  1518   149  1643 0.042 0.119 0.007 525
2714  21332  27 09 00 329800 289100  62100 4.632 0.382 0.057 0.379    42
13306    0    0 3086  991  1631 0.446 0.337 0.059 13303  1913     0
0   945  1145     0   150  1670 0.065 0.214 0.021 323
```

2719 21334 27 09 00 322300 289900 55400 4.472 0.387 0.055 0.500 44
11177 0 2403 2757 0 1582 0.421 0.297 0.040 12625 2546 0
0 0 0 0 160 1669 0.039 0.147 0.012 625
2724 21337 27 09 00 329000 301600 47100 4.657 0.377 0.058 0.278 47
9554 0 5691 5026 0 1607 0.251 0.300 0.033 13205 1585 0 0
0 0 485 148 1646 0.059 0.186 0.016 375
2726 21338 27 09 00 336800 287400 59100 4.593 0.366 0.059 0.385 48
12356 0 3013 2956 0 1612 0.185 0.284 0.036 13196 1817 0
0 0 0 0 152 1654 0.038 0.145 0.007 433
2728 21339 27 09 00 320200 290200 52400 4.689 0.364 0.057 0.260 49
8545 0 3474 4617 0 1607 0.247 0.319 0.032 13094 2064 0 0
309 0 0 144 1683 0.041 0.138 0.010 642
2730 21340 27 09 00 318700 286000 53300 4.658 0.384 0.061 0.527 50
11448 0 6411 3608 0 1623 0.206 0.275 0.046 12608 1626 0
0 534 250 0 140 1664 0.042 0.162 0.017 502
2733 21341 27 09 00 322300 288300 57300 4.782 0.378 0.057 0.458 51
18019 0 802 4057 1492 1648 0.225 0.290 0.051 14104 1663 0
0 772 0 0 150 1685 0.046 0.169 0.018 493
2741 21345 27 09 00 319600 289200 53800 4.689 0.382 0.058 0.425 55
15030 0 1001 3207 1280 1639 0.189 0.328 0.037 13508 1553 0
0 0 0 701 146 1674 0.045 0.192 0.014 486
2743 21346 27 09 00 331100 289200 62200 4.811 0.392 0.057 0.521 56
17369 0 3756 3860 0 1666 0.111 0.287 0.026 13975 1267 0
0 0 0 1014 150 1685 0.045 0.191 0.015 567
2745 21347 27 09 00 325300 303500 41300 4.718 0.368 0.057 0.445 57
16378 0 6137 3612 0 1641 0.250 0.289 0.031 13443 1681 0
0 512 0 0 155 1696 0.052 0.173 0.014 609
2749 21349 27 09 00 324400 289000 60900 4.718 0.398 0.062 0.523 59
16502 0 2387 3309 0 1623 0.331 0.334 0.041 13339 2053 0
0 0 0 454 146 1680 0.044 0.186 0.012 468
2751 21350 27 09 00 330600 303100 47000 4.728 0.365 0.054 0.400 60
13358 0 7915 3073 1480 1576 0.414 0.238 0.036 12791 2366 0
0 0 0 0 149 1660 0.048 0.145 0.011 467
2753 21351 27 09 00 330000 287200 65400 4.760 0.402 0.060 0.512 61
16611 0 2216 3656 0 1627 0.243 0.324 0.032 13711 1729 0
0 496 0 7 161 1685 0.044 0.181 0.012 567
2755 21352 27 09 00 324900 289200 57200 4.708 0.387 0.059 0.461 62
15271 0 3209 3893 9 1632 0.198 0.321 0.031 13301 1769 0
0 748 0 0 160 1685 0.038 0.179 0.012 634
2756 21353 27 09 00 327800 286100 65900 4.615 0.379 0.059 0.452 63
14224 0 1949 3069 0 1614 0.280 0.349 0.045 13226 1883 0
0 829 0 0 175 1665 0.043 0.183 0.014 615
2757 21355 28 09 00 312300 301900 36900 4.641 0.374 0.056 0.431 65
14875 0 7219 3254 1000 1611 0.372 0.279 0.027 12152 1871 0
0 0 0 987 148 1668 0.060 0.165 0.011 470
2758 21354 28 09 00 328900 289200 60500 4.753 0.402 0.060 0.506 64
15998 0 4199 3503 0 1643 0.199 0.341 0.030 13435 1617 0
0 946 1682 0 155 1674 0.043 0.176 0.011 590
2759 21356 28 09 00 329300 287400 63800 4.683 0.399 0.059 0.519 66
14095 0 3685 3156 1006 1595 0.456 0.276 0.032 12779 2168 492
0 0 0 1014 157 1650 0.046 0.150 0.009 420
2764 21358 28 09 00 295400 259300 52600 4.702 0.389 0.057 0.385 177
10233 0 7404 5549 0 1552 0.481 0.329 0.023 10641 2348 0
0 0 0 1013 140 1632 0.044 0.130 0.007 553
2766 21359 28 09 00 296100 267400 44900 4.683 0.360 0.054 0.326 178
10696 0 5637 4921 504 1582 0.465 0.306 0.028 11032 1713 0
0 0 0 1105 181 1626 0.054 0.176 0.011 400

2777 21364 28 09 00 318400 287700 50100 4.666 0.382 0.059 0.399 71
14385 0 3321 3272 951 1631 0.230 0.293 0.031 13152 1655 0
0 0 0 1011 160 1665 0.049 0.165 0.012 542
2785 21368 28 09 00 302300 274300 46700 4.705 0.355 0.056 0.246 75
9308 0 5026 5775 1329 1567 0.384 0.264 0.025 11132 2114 0 0
0 0 497 150 1638 0.041 0.135 0.010 638
2787 21369 28 09 00 326400 287400 61500 4.660 0.378 0.057 0.378 76
15075 0 2291 3351 1287 1589 0.355 0.302 0.033 13125 1807 0
0 925 0 0 161 1651 0.043 0.151 0.009 591
2790 21371 28 09 00 317300 286000 52500 4.689 0.402 0.057 0.328 78
11912 0 1803 3564 0 1615 0.455 0.330 0.042 12493 2271 0
0 542 0 0 157 1697 0.040 0.189 0.019 858
2796 21373 28 09 00 326400 286900 62800 4.638 0.393 0.058 0.197 80
11085 0 0 3284 638 1612 0.301 0.351 0.037 12996 2011 0
0 832 0 0 163 1675 0.040 0.179 0.012 842
2803 21376 28 09 00 327400 276700 68800 4.766 0.383 0.059 0.483 83
15530 0 2400 3275 1013 1628 0.218 0.312 0.034 13066 1450 0
0 909 1820 0 162 1650 0.043 0.176 0.011 463
2805 21377 29 09 00 317700 296100 43600 4.674 0.362 0.058 0.241 84
13127 0 4761 2797 671 1608 0.337 0.293 0.034 12327 1843 0
0 0 0 773 158 1666 0.050 0.174 0.014 476
2811 21380 29 09 00 322400 287000 58600 4.683 0.362 0.058 0.428 87
16136 0 2508 3594 1466 1602 0.356 0.320 0.031 12860 2226 0
0 953 244 0 159 1657 0.050 0.149 0.008 489
2813 21381 29 09 00 321400 285400 63700 4.744 0.367 0.058 0.453 88
17164 0 1988 3827 1504 1599 0.395 0.304 0.032 12997 2176 0
0 527 0 0 161 1667 0.047 0.150 0.009 521
2815 21382 29 09 00 298100 250200 66900 4.724 0.392 0.059 0.547 89
12495 0 6313 3074 1260 1559 0.654 0.220 0.022 10975 2680 0
0 0 0 1763 151 1632 0.042 0.113 0.007 729
2818 21383 29 09 00 322600 297800 47600 4.744 0.376 0.058 0.442 90
15787 0 5811 2414 1407 1599 0.355 0.278 0.025 13121 2736 0
0 0 0 0 165 1700 0.034 0.120 0.008 643
2828 21388 29 09 00 322400 284500 63200 4.740 0.395 0.060 0.485 95
16012 0 1412 4027 1429 1642 0.149 0.282 0.032 13599 1680 0
0 750 0 513 159 1692 0.045 0.132 0.007 558
2832 21390 29 09 00 318300 285100 54800 4.708 0.400 0.061 0.372 97
14495 0 2016 3060 1094 1627 0.180 0.279 0.030 13170 1917 0
0 504 0 0 140 1680 0.035 0.131 0.010 610
2834 21391 29 09 00 299700 258900 56000 4.699 0.394 0.062 0.387 98
10882 0 7076 3641 379 1572 0.401 0.274 0.021 11078 2113 0
0 0 0 702 145 1635 0.045 0.139 0.008 528
2836 21392 29 09 00 319400 302100 43800 4.715 0.390 0.060 0.432 99
18842 0 4009 4111 1495 1609 0.348 0.275 0.032 13305 2527 0
0 0 0 0 157 1691 0.043 0.128 0.009 693
2846 21396 29 09 00 329100 289000 69900 4.865 0.408 0.059 0.535 103
18404 0 3388 3825 1076 1578 0.463 0.292 0.026 13278 2576 0
0 889 1944 0 160 1652 0.048 0.140 0.006 457
2848 21397 29 09 00 300200 270200 44800 4.606 0.336 0.054 0.205 104
13337 0 7098 3015 785 1581 0.128 0.209 0.008 11708 2070 0
0 851 3258 0 148 1642 0.030 0.075 0.004 650
2854 21400 30 09 00 313300 285200 49500 4.526 0.299 0.055 0.136 107
10694 0 1322 5853 0 1621 0.141 0.251 0.026 12096 1657 0
0 0 0 0 161 1673 0.033 0.136 0.010 784
2856 21401 30 09 00 333400 300000 45100 4.766 0.366 0.055 0.283 108
12110 0 5483 2968 806 1591 0.477 0.292 0.031 12289 2315 0
0 0 0 450 157 1662 0.052 0.171 0.012 449

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2858  21402  30 09 00 316500 288000  52400 4.638 0.361 0.057 0.299   109
12362     0 1015 3027  502  1610 0.286 0.312 0.040 12637  2101     0
0     0     0     0   152  1681 0.047 0.176 0.014 498
2860  21403  30 09 00 315600 283300  49800 4.705 0.366 0.055 0.312   110
10506     0 2599 2982    5  1630 0.411 0.377 0.046 12020  1991     0
0     0     0     0   153  1693 0.050 0.245 0.020 496
2866  21406  30 09 00 318900 282400  62600 4.497 0.344 0.057 0.271   113
11883     0 1198 1497    2  1564 0.354 0.274 0.025 12422  2819     0
0     0     0     0   158  1671 0.033 0.115 0.007 672
2868  21407  30 09 00 335300 289000  69500 4.785 0.398 0.061 0.816   114
19423     0 7730 4351    0  1598 0.291 0.259 0.016 13482  2250     0
0     0     0  1499   164  1648 0.045 0.121 0.005 469
2870  21408  30 09 00 326000 289000  58900 4.644 0.374 0.059 0.423   115
13377     0 3103 3077  582  1598 0.359 0.300 0.029 12970  2238     0
0     0     0    10   158  1674 0.039 0.165 0.011 550
2872  21409  30 09 00 324800 283900  64300 4.711 0.351 0.062 0.316   116
11532     0 1687 2837  476  1591 0.322 0.311 0.025 12835  2296     0
0     0     0     0   166  1678 0.043 0.164 0.011 544
2874  21410  30 09 00 321800 290900  53900 4.734 0.390 0.058 0.555   117
15293     0 6990 3321    0  1598 0.363 0.313 0.026 12746  2201     0
0     0     0   501   155  1660 0.045 0.156 0.008 424
2887  21416  30 09 00 323600 302200  46900 4.664 0.340 0.055 0.186   123
9118     0 1109 5534    0  1586 0.411 0.322 0.034 12465  2606     0     0
0     0     0   156  1687 0.041 0.161 0.012 568
2891  21418  30 09 00 317400 284000  55300 4.555 0.344 0.057 0.212   125
12354     0 1108 3039  577  1593 0.384 0.284 0.040 12912  2258     0
0     0     0     0   153  1680 0.036 0.149 0.011 585
2893  21419  30 09 00 326400 299700  49700 4.731 0.387 0.059 0.392   126
15587     0 5999 2790 1210  1612 0.141 0.223 0.013 13690  1993     0
0     0     0     0   168  1669 0.038 0.118 0.006 494
2895  21420  30 09 00 325700 289100  60700 4.734 0.381 0.057 0.402   127
14887     0 1117 3229 1024  1643 0.154 0.305 0.036 13879  1506     0
0   451     0     3   155  1683 0.047 0.184 0.013 466
2897  21421  30 09 00 326500 284800  64200 4.727 0.369 0.055 0.296   128
13725     0 1116 3094  903  1619 0.168 0.267 0.024 13496  1616     0
0     0     0     0   154  1669 0.042 0.162 0.010 501
2899  21422  30 09 00 326700 302300  47100 4.676 0.350 0.055 0.260   129
12617     0 2806 3043  879  1620 0.214 0.276 0.033 13241  1690     0
0   621   618     0   156  1668 0.040 0.153 0.011 533
2904  21424  30 09 00 297300 270100  44500 4.619 0.387 0.057 0.442   131
13112     0 8567 3077  608  1561 0.447 0.221 0.014 11208  2261     0
0   347  1263     0   142  1622 0.040 0.101 0.004 533
2906  21425  01 10 00 312400 288000  48400 4.638 0.393 0.058 0.416   132
15950     0 1841 3945 1434  1618 0.255 0.322 0.028 13069  1670     0
0     0     0   750   148  1667 0.046 0.161 0.009 460
2914  21429  01 10 00 323000 295100  48500 4.766 0.368 0.057 0.352   136
12393     0 6195 3047  842  1618 0.238 0.310 0.031 12817  1847     0
0     0     0     0   176  1675 0.049 0.185 0.013 603
2923  21434  01 10 00 317300 278700  69500 4.724 0.377 0.057 0.360   181
14556     0     0 3202 1206  1585 0.447 0.316 0.040 12797  2356     0
0     0     0   643   168  1660 0.048 0.168 0.010 467
2925  21435  01 10 00 324000 297700  54800 4.712 0.403 0.058 0.463     0
17292     0 1029 3845 1498  1593 0.245 0.292 0.030 13976  2507     0
0     0     0     0   177  1684 0.045 0.119 0.007 741
2931  21436  01 10 00 310100 289800  44400 4.466 0.376 0.057 0.373     1
13800     0  501 3477    0  1603 0.415 0.302 0.047 12996  1886     0
0     0     0   111   169  1672 0.039 0.183 0.023 757
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0 0 0 211 187 1643 0.055 0.177 0.012 562
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11817 0 5685 2681 426 1561 0.314 0.309 0.016 11530 1847 0
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15985 0 1203 3526 0 1618 0.240 0.313 0.022 13504 1589 0
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14682 0 779 3178 0 1602 0.240 0.289 0.022 13321 1935 0
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16815 0 5986 4216 0 1590 0.234 0.201 0.008 13449 2190 0
0 0 0 0 189 1671 0.038 0.093 0.005 794
2952 21446 02 10 00 301700 282400 40100 4.459 0.373 0.058 0.479 11
13430 0 5991 3061 421 1589 0.353 0.252 0.035 11711 1808 0
0 1010 0 118 172 1642 0.040 0.121 0.012 852
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12527 0 1257 2956 0 1570 0.244 0.206 0.006 12652 2308 0
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15978 0 4102 3957 0 1636 0.155 0.234 0.014 13076 1270 0
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9492 0 0 4148 0 1582 0.355 0.275 0.043 12005 1809 0 0
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0 0 0 1012 204 1655 0.051 0.175 0.012 635
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12050 0 1518 5458 541 1587 0.561 0.334 0.037 12385 2325 0
0 0 0 0 203 1668 0.067 0.229 0.018 540
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0 0 0 1166 214 1665 0.083 0.211 0.020 411

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17814     0 3545 3954  492  1621 0.287 0.295 0.033 13452  1830     0
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16246     0 5468 3530 1478  1605 0.405 0.304 0.038 12934  2079     0
0   0    0  487   212  1667 0.051 0.172 0.013 543
3077  21508  04 10 00 324500 289100  59600 4.670 0.389 0.057 0.419   53
15579     0 5319 3408 1354  1617 0.309 0.326 0.031 12975  1880     0
0   0    0 1196   214  1660 0.058 0.191 0.014 689
3085  21512  04 10 00 332200 292200  59100 4.670 0.393 0.060 0.405   57
16164     0 2800 3559 1467  1632 0.190 0.268 0.028 13591  1553     0
0   0    0  539   220  1669 0.043 0.166 0.012 560
3090  21514  05 10 00 326600 286700  63800 4.820 0.371 0.057 0.432   59
17307     0  909 3828 1477  1586 0.459 0.284 0.026 13696  2503     0
0   0    0    0   220  1673 0.044 0.143 0.011 818
3093  21515  05 10 00 325500 287200  60600 4.744 0.372 0.059 0.463   60
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0   0    0    0   217  1669 0.047 0.159 0.010 729
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19301     0 1668 5132 1500  1621 0.290 0.298 0.024 13942  2010     0
0  889  526    0   217  1678 0.049 0.145 0.009 662
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20035     0 4737 4972 1270  1634 0.236 0.256 0.021 13700  1898     0
0  889  568    0   222  1672 0.050 0.128 0.009 823
3108  21521  05 10 00 312600 284800  54300 4.776 0.421 0.059 0.541   66
19199     0 2184 4787 1500  1599 0.449 0.306 0.021 13203  3330     0
0  906    0    0   225  1713 0.040 0.109 0.008 777
3112  21522  05 10 00 326900 299600  57900 4.689 0.422 0.057 0.352   67
14795     0 2806 3531  945  1582 0.473 0.308 0.022 13468  3027     0
0   0    0    0   225  1691 0.045 0.135 0.010 1178
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14043     0 2798 3096  602  1611 0.384 0.320 0.026 13341  1935     0
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0   0    0    0   223  1690 0.043 0.163 0.013 807
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3128  21530  05 10 00 315300 293100  51700 4.724 0.380 0.057 0.406   75
15997     0 1818 3483 1443  1618 0.369 0.304 0.028 13628  2001     0
0   0    0  752   221  1691 0.044 0.154 0.011 753
3130  21531  06 10 00 324200 299700  52400 4.833 0.379 0.054 0.419   76
16920     0 5101 3751 1495  1632 0.209 0.266 0.022 13875  1690     0
0   0    0 1402   226  1683 0.050 0.142 0.010 825
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16886 0 6028 3756 1500 1580 0.361 0.260 0.017 13293 1924 0
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3141 21536 06 10 00 318400 285800 57000 4.689 0.396 0.060 0.415 81
11995 0 4946 2949 538 1581 0.418 0.304 0.020 12656 2629 0
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3142 21537 06 10 00 318700 287100 54600 4.727 0.386 0.058 0.486 82
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3148 21540 06 10 00 321200 296700 48400 4.728 0.376 0.059 0.402 85
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13206 0 633 3055 0 1636 0.318 0.348 0.033 13453 1549 0
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15119 0 324 3297 0 1633 0.375 0.360 0.037 13783 1850 0
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10394 0 3120 2994 589 1607 0.401 0.340 0.032 12434 1933 0
0 0 0 743 206 1680 0.047 0.188 0.018 852
3178 21553 07 10 00 324400 293000 61500 4.612 0.351 0.058 0.389 98
14104 0 0 3067 1052 1609 0.217 0.306 0.027 13751 1674 0
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3180 21554 07 10 00 311200 290800 48100 4.693 0.366 0.058 0.445 99
15249 0 4024 3353 1044 1626 0.233 0.273 0.020 13052 1308 0
0 0 0 24 207 1668 0.065 0.183 0.012 647
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3184 21556 07 10 00 324500 297500 55000 4.545 0.312 0.057 0.256 101
10496 0 0 3075 545 1594 0.240 0.285 0.027 13011 1811 0
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3186 21557 07 10 00 318400 292800 54100 4.670 0.338 0.059 0.342 102
10660 0 0 3066 530 1589 0.482 0.300 0.027 12430 1823 0
0 0 0 535 214 1644 0.065 0.201 0.017 494
3200 21564 07 10 00 315600 299100 39600 4.600 0.328 0.058 0.281 110
11130 0 3766 2757 647 1596 0.426 0.302 0.023 12446 2068 0
0 0 0 0 207 1672 0.042 0.172 0.015 894
3202 21565 07 10 00 320400 290100 58400 4.673 0.338 0.055 0.267 111
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3209 21568 07 10 00 318900 292300 53600 4.728 0.394 0.062 0.653 114
18522 0 3783 4249 1315 1631 0.275 0.276 0.035 13384 1681 495
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3210 21569 07 10 00 321300 301100 45600 4.552 0.355 0.058 0.433 115
15254 0 3787 3312 855 1594 0.487 0.286 0.024 12965 2247 0
0 0 0 304 207 1670 0.047 0.166 0.012 735

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3226  21577  08 10 00 297600 251100  73400 4.849 0.426 0.062 0.739   123
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3232  21580  08 10 00 313600 289100  49200 4.673 0.359 0.057 0.434   126
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0     0  2079   449   203  1689 0.039 0.163 0.014 731
3234  21581  08 10 00 320200 290000  52200 4.731 0.365 0.057 0.416   127
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18971     0 3767 4358 1000  1648 0.266 0.281 0.031 13349  1799   498
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3242  21584  08 10 00 318300 298000  47200 4.683 0.368 0.058 0.407   130
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15685     0 5386 3427 1108  1594 0.517 0.283 0.026 12907  2335     0
0     0     4   220   205  1674 0.055 0.157 0.013 506
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3266  21594  08 10 00 325000 288200  55100 4.670 0.382 0.058 0.394   140
10718     0 3775 5117  308  1610 0.412 0.387 0.029 12636  1899     0
0     0     0   603   210  1663 0.068 0.230 0.018 631
3269  21595  09 10 00 309400 297400  39100 4.414 0.328 0.059 0.251   141
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0   572     0     0   205  1660 0.046 0.111 0.012 1120
3276  21598  09 10 00 307500 288300  45100 4.548 0.317 0.056 0.278   144
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0     0     0     0   207  1691 0.042 0.116 0.010 1129
3278  21599  09 10 00 308700 287000  48000 4.500 0.328 0.058 0.234   145
14123     0 1103 3100 1129  1594 0.373 0.275 0.029 12547  2106     0
0     0     0     0   210  1673 0.038 0.134 0.011 1007
3280  21600  09 10 00 317400 289000  56900 4.734 0.378 0.053 0.368   146
14719     0 2516 3288 1012  1601 0.494 0.318 0.027 12818  2109     0
0     0     0   938   212  1659 0.063 0.206 0.017 483
3282  21601  09 10 00 317100 288000  57700 4.705 0.377 0.054 0.332   147
12904     0 2905 3079  918  1604 0.395 0.330 0.037 12691  1982     0
0     0     0   464   212  1672 0.054 0.178 0.015 658
3289  21605  09 10 00 314200 298900  42500 4.443 0.315 0.054 0.256   151
10309     0  689 3083  484  1570 0.517 0.295 0.027 12078  2443     0
0     0     0    98   210  1647 0.047 0.167 0.014 685
3291  21606  09 10 00 316800 287000  54800 4.571 0.331 0.055 0.343   152
12530     0 1209 3077  830  1591 0.502 0.306 0.028 12477  2155     0
0     0     0    99   214  1659 0.051 0.164 0.014 743
3295  21608  09 10 00 318000 293100  58000 4.740 0.392 0.059 0.439   154
16992     0 6189 3784 1494  1587 0.365 0.280 0.021 13063  2030     0
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3297  21609  09 10 00 320400 286900  64900 4.746 0.384 0.058 0.360   155
14401     0 1503 3276 1169  1587 0.475 0.319 0.023 12881  2279     0
0     0     0  1553   218  1651 0.042 0.141 0.010 768
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3299  21610  09 10 00 319100 287900  58400 4.683 0.327 0.056 0.366   156
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0     0     0  886   214  1645 0.046 0.142 0.012 890
3301  21611  09 10 00 331600 297000  59900 4.612 0.392 0.058 0.387   157
12588     0 5013 3090  855  1597 0.404 0.345 0.026 12876  2171     0
0   198     0     0  214  1673 0.046 0.169 0.011 843
3306  21614  09 10 00 323000 295200  52800 4.602 0.376 0.058 0.412   160
13178     0 5217 3089  523  1579 0.412 0.287 0.019 13108  2238     0
0   501     0     0  214  1662 0.044 0.139 0.010 874
3309  21615  09 10 00 295700 250700  68600 4.727 0.377 0.059 0.451   161
11653     0 2048 3020  533  1593 0.280 0.342 0.019 12073  1710     0
0   806     0     0  200  1646 0.044 0.148 0.009 825
3311  21616  09 10 00 327500 287100  60600 4.766 0.363 0.053 0.287   162
11719     0 2405 2848  704  1626 0.161 0.300 0.024 13408  1469     0
0     0     0     0  211  1669 0.046 0.174 0.015 826
3317  21619  09 10 00 322400 287800  55100 4.670 0.366 0.056 0.289   165
10311     0 3878 7003  502  1589 0.337 0.335 0.019 12739  1741     0
0   537     0     0  209  1652 0.047 0.164 0.010 753
3321  21621  10 10 00 298900 253700  61300 4.786 0.394 0.060 0.389   167
10731     0 6072 3754  417  1586 0.238 0.317 0.014 11505  1830     0
0     0  1344  2073  200  1633 0.041 0.138 0.008 968
3323  21622  10 10 00 297100 260500  57900 4.734 0.383 0.059 0.370   168
10119     0 3939 4997  354  1593 0.147 0.259 0.011 11780  1653     0
0     0     0  1215  200  1645 0.041 0.135 0.008 915
3327  21624  10 10 00 318200 281100  67800 4.824 0.393 0.059 0.456   170
17395     0 2251 3384    0  1603 0.407 0.325 0.023 13227  1938     0
0   943   682     0  203  1661 0.051 0.163 0.009 714
3331  21627  10 10 00 311500 295800  46200 4.670 0.354 0.055 0.287   173
10349     0 1195 3647    0  1620 0.340 0.314 0.043 13201  2371     0
0     0     0     0  201  1710 0.030 0.124 0.015 1110
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A4.3 Data set D3

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Heatno Chargno date    Wbath   Gry  Gschrot C_ry Mn_ry P_ry Si_ry Lnslf
Lime1 dolml Ore1 Rslg1 Rdl1 T1    C1    Mn1   P1    O21   O22  lime2
dolm2 Ore2 Rslg2 Rdl2 Hlns2  T2   C2   Mn2   P2   Oact2
3337  21631  10 10 00 296500 276500  51100 4.552 0.367 0.058 0.419   177
11858     0 3655 3075  491  1565 0.613 0.277 0.021 11597  2393     0
0     0     0  1805  182  1626 0.045 0.117 0.009 891
3346  21635  10 10 00 307100 294300  38000 4.436 0.332 0.058 0.246   181
14985     0    0 3081  858  1584 0.555 0.267 0.042 12637  3193     0
0     0     0     0  220  1711 0.032 0.117 0.012 1522
3352  21637  11 10 00 317900 295300  49200 4.427 0.338 0.058 0.256   183
11002     0 1020 2967  430  1567 0.383 0.246 0.025 13121  2210     0
0   579     0     0  211  1642 0.039 0.102 0.009 834
3355  21638  11 10 00 324000 299300  49500 4.577 0.353 0.059 0.377   185
11222     0 2140  499  985  1584 0.490 0.293 0.031 13239  2337     0
0   939  1027     0  196  1655 0.051 0.155 0.014 700
3361  21640  11 10 00 316400 295500  54800 4.497 0.332 0.061 0.486   187
16992     0    0  487    0  1587 0.377 0.246 0.032 13677  2617     0
0     0     0     0  213  1689 0.033 0.109 0.011 1106
3363  21641  11 10 00 314600 295000  46200 4.616 0.376 0.060 0.514   188
15917     0 1512 3626 1461  1627 0.298 0.307 0.040 13839  1988     0
0     0     0     0  195  1704 0.036 0.161 0.017 1103
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3379  21647  12 10 00 307900 295500  41700 4.465 0.336 0.056 0.383   194
13589    0  984 3073 1033   1596 0.366 0.254 0.030 13053  2225     0
0     0     0     0   205   1694 0.041 0.125 0.013 989
3386  21650  12 10 00 320600 294100  53900 4.571 0.369 0.056 0.362   197
12582    0 1680 3084  623   1593 0.355 0.304 0.018 13442  1951     0
0     0     0     0   213   1674 0.047 0.160 0.010 615
3391  21652  12 10 00 323200 290600  46500 4.414 0.354 0.058 0.546   199
15841    0  602 3479  775   1641 0.127 0.226 0.016 13854  1348     0
0   706     0     0   212   1672 0.039 0.133 0.009 767
3393  21653  12 10 00 289500 250700  64000 4.625 0.383 0.061 0.649   200
12339    0 5619 3066    0   1565 0.327 0.277 0.019 11459  1997     0
0   942   243     0   196   1630 0.044 0.112 0.007 882
3397  21655  12 10 00 316900 292300  51700 4.584 0.326 0.056 0.305   202
11005    0 1081 2707  552   1595 0.247 0.284 0.025 12953  1990     0
0     0     0     0   220   1669 0.038 0.134 0.012 1091
3399  21656  12 10 00 315700 303200  39400 4.686 0.353 0.057 0.300   203
11921    0 8242 2657  403   1564 0.372 0.239 0.014 12269  2488     0
0     0     0     0   220   1668 0.037 0.102 0.008 1010
3403  21657  12 10 00 313600 291000  53100 4.465 0.323 0.054 0.271   204
11657    0  487 2840  361   1555 0.309 0.241 0.023 13118  2477     0
0     0     0     0   217   1661 0.034 0.085 0.010 1352
3404  21658  12 10 00 305800 292000  44500 4.549 0.370 0.056 0.365   205
13953    0  399 3060  925   1610 0.284 0.272 0.033 13174  2020     0
0     0     0   344   205   1674 0.045 0.160 0.015 866
3407  21659  12 10 00 307300 283100  64800 4.648 0.388 0.061 0.326   206
11457    0     0 2837  598   1575 0.568 0.323 0.026 12618  2615     0
0     0     0   380   211   1647 0.050 0.171 0.013 685
3411  21661  12 10 00 322300 293200  61100 4.737 0.361 0.058 0.504   208
18004    0     0 3981 1504   1631 0.171 0.242 0.017 14118  1570     0
0     0     0   615   213   1674 0.058 0.151 0.012 697
3413  21662  12 10 00 312500 290000  51000 4.622 0.360 0.058 0.398   209
15002    0     0 3278 1276   1602 0.329 0.279 0.027 13342  1944     0
0     0     0     0   206   1674 0.047 0.158 0.013 641
3416  21663  12 10 00 303600 283900  47800 4.763 0.408 0.058 0.545   210
19997    0 6746 4525 1499   1593 0.324 0.274 0.016 12658  1844     0
0   576     0  1504   203   1649 0.054 0.124 0.006 857
3419  21665  12 10 00 320800 288100  63000 4.705 0.370 0.057 0.436   212
15940    0     0 3251  750   1631 0.324 0.326 0.027 13570  1771  2038
0     0     0   878   210   1677 0.048 0.201 0.016 821
3422  21666  13 10 00 321100 293000  59400 4.744 0.391 0.059 0.489   213
18024    0 1288 4030 1504   1595 0.527 0.311 0.025 13353  2285     0
0     0     0  1181   211   1660 0.054 0.163 0.010 643
3426  21668  13 10 00 320000 290100  58400 4.577 0.376 0.059 0.500   215
16088    0 1793 3578 1462   1575 0.428 0.252 0.019 13302  2147     0
0   491     0     0   229   1647 0.051 0.130 0.009 648
3428  21669  13 10 00 322200 294000  57400 4.631 0.415 0.061 0.420   216
13421    0 2385 3006 1000   1614 0.314 0.315 0.027 13050  1867   496
0     0     0     0   219   1671 0.049 0.188 0.014 849
3431  21671  13 10 00 297400 260800  56700 4.721 0.412 0.057 0.299   218
8498     0 5850 5140    0   1579 0.441 0.295 0.033 10964  2083     0     0
0     0  1171   207   1629 0.064 0.145 0.010 451
3433  21672  13 10 00 317300 298900  41900 4.682 0.385 0.058 0.339   219
11363    0 6312 2590  996   1591 0.385 0.296 0.027 12271  2204   493
0     0     0     0   219   1675 0.047 0.168 0.014 968
3436  10001  13 10 00 320200 296400  52100 4.769 0.414 0.059 0.523    46
16289    0 5269 5065    0   1642 0.236 0.319 0.032 15400  1349     0
0     0     0     0   191   1684 0.058 0.178 0.012 336
```

3438 10002 13 10 00 319400 289600 60800 4.619 0.404 0.058 0.440 47
11968 0 0 3951 0 1624 0.375 0.321 0.026 13449 1735 0
0 0 0 444 189 1672 0.066 0.205 0.011 242
3439 21674 13 10 00 319500 278400 66600 4.891 0.407 0.058 0.548 221
13046 0 5754 3566 0 1588 0.353 0.295 0.018 12559 2478 0
0 0 0 0 219 1681 0.034 0.111 0.009 1269
3441 10003 13 10 00 318000 307600 35800 4.583 0.401 0.059 0.382 48
14201 0 2736 3153 337 1641 0.324 0.302 0.020 13584 1688 1020
0 0 0 391 185 1683 0.088 0.198 0.012 260
3442 10004 13 10 00 318300 298200 43900 4.670 0.418 0.059 0.419 49
12362 0 1108 2185 998 1662 0.380 0.378 0.044 13330 1878 0
0 84 0 0 169 1694 0.062 0.195 0.013 336
3444 10005 13 10 00 311300 290400 47900 4.628 0.366 0.058 0.398 50
13491 0 2014 3442 1001 1630 0.382 0.301 0.031 13048 1841 504
0 0 0 1497 178 1674 0.062 0.156 0.009 378
3445 21675 13 10 00 293400 262500 53000 4.622 0.351 0.060 0.427 222
9193 0 5036 4418 0 1573 0.559 0.290 0.034 11368 2046 0 0
941 2299 0 204 1624 0.057 0.133 0.014 764
3446 10006 13 10 00 325900 294600 54600 4.818 0.422 0.060 0.538 51
14441 0 5814 3519 999 1626 0.418 0.350 0.029 13083 2107 0
0 0 0 1503 192 1673 0.081 0.173 0.009 309
3448 10007 13 10 00 309100 267300 68300 4.798 0.405 0.060 0.650 52
13284 0 3394 3311 0 1615 0.490 0.364 0.038 12193 2290 0
0 501 0 2175 183 1660 0.054 0.157 0.009 390
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11303 0 3798 2831 0 1582 0.600 0.305 0.031 12319 2641 0
0 0 0 1138 189 1658 0.069 0.174 0.010 329
3453 21678 13 10 00 321400 286900 63700 4.641 0.379 0.054 0.362 225
11069 0 2003 2708 0 1590 0.344 0.307 0.020 12876 2095 0
0 0 0 0 224 1661 0.046 0.161 0.010 916
3454 10010 13 10 00 323300 289900 57800 4.818 0.403 0.060 0.507 55
13529 0 8927 3302 0 1612 0.409 0.333 0.030 13013 2193 0
0 0 0 1058 197 1685 0.056 0.154 0.010 591
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0 927 1064 0 199 1674 0.074 0.190 0.013 472
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14787 0 1822 3271 366 1629 0.148 0.267 0.025 13380 1492 0
0 300 0 0 215 1670 0.041 0.137 0.013 957
3458 10012 13 10 00 318700 303300 40800 4.833 0.387 0.060 0.383 57
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0 495 0 0 209 1708 0.070 0.205 0.015 387
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0 917 1105 0 192 1635 0.063 0.127 0.011 716
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12654 0 2218 3107 888 1614 0.428 0.354 0.032 13202 2380 0
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15693 0 3711 3444 984 1605 0.285 0.288 0.019 13445 2034 0
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3477 10021 14 10 00 290900 257300 58600 4.868 0.367 0.051 0.347 118
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0 497 0 0 238 1638 0.052 0.109 0.005 533

3479 10022 14 10 00 299600 252400 65600 4.776 0.368 0.064 0.446 119
11083 0 8066 3513 0 1572 0.399 0.261 0.023 11531 2073 0
0 0 0 1701 240 1630 0.048 0.100 0.007 708
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13340 0 4493 3035 896 1622 0.333 0.285 0.041 13312 1960 0
0 0 0 0 230 1689 0.040 0.150 0.017 889
3485 10025 14 10 00 314100 287900 58400 4.724 0.401 0.061 0.424 122
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11537 0 7949 2843 0 1607 0.232 0.274 0.027 12581 1583 0
0 234 0 0 204 1659 0.048 0.163 0.016 874
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0 392 0 0 210 1650 0.049 0.151 0.015 876
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0 1 0 0 240 1660 0.052 0.165 0.011 480
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0 897 1061 0 235 1657 0.094 0.198 0.013 318
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0 902 494 0 229 1673 0.059 0.203 0.012 391
3520 10041 14 10 00 314800 288100 55900 4.728 0.370 0.068 0.489 138
14976 0 3703 3450 729 1611 0.407 0.277 0.026 13365 2577 0
0 0 0 0 237 1723 0.041 0.128 0.008 664
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0 958 5 0 239 1673 0.046 0.140 0.009 509
3529 10046 15 10 00 316000 283000 58600 4.734 0.369 0.061 0.445 143
12514 0 3606 3069 996 1620 0.294 0.292 0.020 13002 1817 0
0 222 0 12 230 1673 0.053 0.167 0.008 396
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0 395 0 0 227 1671 0.061 0.176 0.011 396
3536 10049 15 10 00 298200 260200 60200 4.721 0.354 0.062 0.293 146
11010 0 5239 2687 997 1542 0.450 0.231 0.010 11387 2294 0
0 52 0 0 215 1629 0.054 0.117 0.005 388

3537 21703 15 10 00 313900 296300 43700 4.772 0.378 0.064 0.347 126
12623 0 4379 3069 887 1616 0.306 0.311 0.041 12567 1805 0
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0 0 0 1032 222 1679 0.084 0.167 0.013 725
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16674 0 2146 4063 350 1653 0.389 0.301 0.030 13715 1963 0
0 329 0 0 230 1705 0.062 0.199 0.015 368
3570 10064 15 10 00 315800 290100 52700 4.744 0.370 0.061 0.462 161
13886 0 2760 3453 1079 1643 0.333 0.284 0.024 13138 1870 0
0 901 0 0 229 1686 0.053 0.161 0.010 332
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16042 0 3319 3834 0 1645 0.285 0.289 0.027 12923 1857 0
0 904 153 0 223 1692 0.048 0.164 0.010 416
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9971 0 5311 2867 0 1602 0.496 0.314 0.023 12392 2286 0 0
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0 870 0 0 229 1671 0.049 0.160 0.008 449
3616 10086 16 10 00 320600 285700 58100 4.750 0.391 0.064 0.570 183
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3636 10099 17 10 00 312800 275800 63900 4.622 0.368 0.062 0.404 196
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13726 4705 3029 513 0 1630 0.223 0.184 0.013 14121 1636 0
0 362 0 0 222 1667 0.072 0.133 0.008 299
3642 10103 17 10 00 318600 292800 51800 4.661 0.379 0.062 0.585 200
12217 4299 3592 939 0 1642 0.375 0.283 0.022 13310 1712 0
0 1049 2489 0 223 1661 0.105 0.172 0.010 266
3651 10107 18 10 00 318300 302900 42400 4.597 0.347 0.061 0.545 204
8991 3084 4291 500 0 1634 0.449 0.283 0.034 13196 2066 0 0
0 0 0 226 1688 0.076 0.187 0.016 341
3653 10108 18 10 00 325400 303200 45800 4.644 0.355 0.060 0.415 205
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0 0 2196 230 1671 0.078 0.182 0.016 330
3663 10113 18 10 00 316700 300200 44600 4.641 0.369 0.063 0.478 210
10807 5175 2878 519 0 1665 0.306 0.312 0.041 13672 1791 0
0 898 1963 0 210 1687 0.069 0.175 0.014 412
3667 10115 18 10 00 324400 290000 61800 4.750 0.366 0.065 0.815 212
16964 1113 4540 1873 354 1628 0.266 0.247 0.017 14056 1897 0
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3669 10116 18 10 00 321700 298900 52900 4.709 0.379 0.062 0.607 213
13248 5994 4911 468 0 1646 0.348 0.269 0.022 14021 1920 0
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3671 10117 18 10 00 318300 291400 51500 4.747 0.380 0.062 0.614 214
12488 0 7588 3561 0 1612 0.414 0.264 0.019 12719 2189 0
0 0 0 239 211 1674 0.053 0.142 0.008 417
3673 10118 18 10 00 317400 286400 52300 4.756 0.371 0.069 0.597 215
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12060 5196 5757 494 967 1661 0.421 0.237 0.020 13563 1987 0
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3677 10120 18 10 00 312100 300600 45000 4.670 0.368 0.060 0.492 217
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0 901 727 0 200 1670 0.087 0.131 0.007 342
3683 10123 18 10 00 318200 281700 63900 4.859 0.374 0.054 0.385 220
7166 4348 5289 1056 0 1620 0.407 0.200 0.016 13124 2300 0 0
0 0 707 208 1688 0.049 0.121 0.010 557
3685 10124 19 10 00 323800 289800 58000 4.817 0.402 0.062 0.409 221
7700 4468 7691 997 0 1602 0.496 0.189 0.013 12985 2379 0 0
509 0 0 209 1681 0.049 0.114 0.008 557

A4.4 Data set D4

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Heatno Chargno date    Wbath   Gry  Gschrot C_ry Mn_ry P_ry Si_ry Lnslf
Lime1 dolm1 Ore1 Rslg1 Rdl1 T1    C1    Mn1   P1    O21   O22  lime2
dolm2 Ore2 Rslg2 Rdl2 Hlns2  T2   C2  Mn2   P2   Oact2
3687  10125  19 10 00 312200 289800  48100 4.647 0.368 0.060 0.428   222
12232    3 4978 3019  297  1623 0.259 0.280 0.021 13258  1789    0
0  645    0    0   203  1674 0.049 0.149 0.008 447
3688  10126  19 10 00 329700 297800  57600 4.673 0.375 0.062 0.424   223
8577 4436 4988    0  991  1607 0.378 0.279 0.023 13250  1909   497    0
603     0    0   207  1663 0.050 0.151 0.009 399
3691  10127  19 10 00 316400 286900  56000 4.737 0.359 0.062 0.448   224
7562 4594 6328 1020    0  1599 0.560 0.185 0.018 12675  2284     0    0
704    92    0   202  1670 0.062 0.122 0.008 433
3693  10128  19 10 00 319600 283600  64700 4.711 0.363 0.059 0.448   225
7323 4668 3709  974    0  1609 0.525 0.208 0.023 12841  2133     0    0
949     3    0   203  1657 0.074 0.150 0.009 346
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502     0    0   203  1660 0.047 0.113 0.008 583
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901   759    0   176  1673 0.053 0.162 0.013 380
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12941 4674 3640  510    0  1601 0.548 0.262 0.036 12454  2355    0
0  917  5014    0   173  1632 0.069 0.156 0.008 327
3715  10140  19 10 00 319900 272700  74500 4.670 0.375 0.057 0.483    74
7440 4405 4500  959    0  1577 0.556 0.168 0.019 12236  2644     0    0
518     0    0   175  1654 0.048 0.107 0.007 491
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0     0    0   180  1672 0.047 0.165 0.012 492
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898   994    0   186  1665 0.076 0.189 0.012 348
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0  615   130    0   188  1667 0.073 0.164 0.010 299
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14487 0 2509 0 3635 1645 0.370 0.290 0.026 13760 2164 507
0 894 2470 0 244 1686 0.073 0.156 0.009 361
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8597 4378 2003 477 0 1606 0.289 0.266 0.021 13567 2243 0 0
0 0 0 182 1682 0.041 0.138 0.010 664
3967 10264 24 10 00 330900 291500 70400 4.702 0.372 0.055 0.439 37
8966 4078 3298 986 0 1594 0.429 0.173 0.015 13602 2334 0 0
0 2059 0 193 1656 0.060 0.104 0.007 520
3971 10266 24 10 00 322100 289300 59000 4.731 0.364 0.054 0.454 39
8096 4659 3603 983 0 1603 0.387 0.156 0.011 13625 2289 0 0
0 0 0 189 1682 0.045 0.097 0.009 732

Appendix 5
Listing of optimization results

Table A5.1 Optimization results for dataset D1

Heat#	O22	LIM2	DOL O2	ORE 2	RSL2	RDO LO2	HL2	C2	T2	Mn2	P2	Oact2	Violations	Cost
1739	2240	0	0	0	0	1516	217	0.043	1625	0.105	0.007	618	------	------
OP#1	2283	400	0	0	0	0	250	0.0463	1645	0.135	0.0077	780	-T--P--	236.83
OP#2	2273	0	2000	0	0	1501	209	0.0464	1624	0.105	0.0061	639	-------	12.57
OP#3	2271	219	0	876	1877	0	222	0.0452	1625	0.1011	0.007	621	-------	10.36
1740	2339	0	0	0	0	463	214	0.046	1659	0.132	0.009	877	------	------
OP#1	2559	365	0	0	0	0	223	0.046	1670	0.1356	0.0089	877	-------	13.38
OP#2	2679	127	547	0	491	0	243	0.0461	1659	0.131	0.0079	878	-------	1.03
OP#3	2351	0	0	881	66	0	195	0.0456	1660	0.1295	0.009	763	-------	16.19
1741	1781	0	0	0	0	729	221	0.046	1662	0.124	0.006	644	------	------
OP#1	2173	416	0	0	0	0	250	0.0453	1677	0.1324	0.0065	806	----P--	130.72
OP#2	2029	0	999	0	0	1032	216	0.0511	1657	0.1234	0.006	755	-------	33.68
OP#3	2200	2	0	744	623	0	247	0.0462	1663	0.124	0.0048	642	-------	1.17
1743	1861	0	0	0	0	512	212	0.056	1656	0.14	0.011	631	------	------
OP#1	1779	1	2	0	0	0	224	0.0516	1656	0.1693	0.0093	630	-------	28.92
OP#2	2097	0	1994	0	0	497	250	0.0539	1651	0.1535	0.008	631	-------	18.21
OP#3	1975	16	1980	734	0	0	217	0.0509	1656	0.1399	0.0082	632	-------	9.69
1744	1475	0	0	0	0	1101	236	0.06	1654	0.209	0.013	352	------	------
OP#1	1100	0	0	0	0	0	250	0.0551	1661	0.2036	0.0116	462	-------	48.72
OP#2	1259	0	1986	0	0	375	241	0.0642	1652	0.2089	0.013	352	-------	8.77
OP#3	1100	352	0	38	7	0	250	0.0602	1654	0.2012	0.0122	352	-------	4.26
1745	1703	0	0	0	0	343	212	0.045	1666	0.141	0.014	865	------	------
OP#1	1968	0	0	0	0	0	196	0.045	1668	0.1432	0.0106	867	-------	3.67
OP#2	2143	43	280	0	7	458	228	0.0451	1666	0.1411	0.0106	865	-------	0.35
OP#3	1723	65	1998	99	0	0	197	0.0439	1664	0.1411	0.0126	863	-------	4.56
1751	1802	0	0	0	0	0	213	0.04	1685	0.149	0.01	886	------	------
OP#1	2075	421	192	0	0	0	250	0.0425	1685	0.1353	0.0087	885	-------	15.58
OP#2	2351	0	1064	0	0	0	232	0.04	1685	0.1257	0.0089	945	-------	22.45
OP#3	2012	0	166	220	2	0	222	0.04	1685	0.137	0.01	877	-------	9.15
1752	1995	0	0	460	0	0	238	0.05	1690	0.184	0.011	579	------	------
OP#1	1902	61	147	0	0	0	250	0.0511	1690	0.1714	0.0109	579	-------	9.05
OP#2	2273	0	2000	0	0	0	245	0.0513	1685	0.1581	0.0108	680	-------	39.1
OP#3	1894	146	0	62	0	0	250	0.0501	1685	0.1765	0.0107	600	-------	12.9
1755	1789	0	0	0	0	0	238	0.042	1703	0.152	0.009	524	------	------
OP#1	2036	0	0	0	0	0	250	0.0445	1704	0.1567	0.0102	672	----P--	171.17
OP#2	2038	0	2000	0	0	1001	249	0.051	1676	0.1416	0.009	706	CT-O-	398.68
OP#3	2349	0	0	1051	0	0	244	0.0417	1695	0.1225	0.006	688	-T-----	89.83
1756	1564	0	0	0	0	0	235	0.044	1696	0.154	0.009	700	------	------
OP#1	2131	498	0	0	0	0	250	0.044	1704	0.1439	0.0105	862	----P--	206.05
OP#2	2349	0	1251	0	0	954	250	0.0454	1689	0.1276	0.009	804	-T-----	62.38
OP#3	2058	62	0	538	237	0	240	0.0442	1696	0.1444	0.0087	697	-------	7.07
1760	2186	0	1	0	0	0	225	0.046	1683	0.154	0.012	769	------	------
OP#1	2209	30	999	0	0	0	248	0.046	1682	0.1476	0.011	770	-------	4.9
OP#2	2332	0	25	0	0	0	222	0.0459	1678	0.1448	0.0106	870	-------	24.13
OP#3	2224	0	29	23	0	0	250	0.0437	1680	0.154	0.0103	769	-------	8.2

1767	1505	0	0	0	0	176	224	0.052	1671	0.193	0.015	720	------	------
OP#1	1437	218	821	0	0	0	238	0.053	1671	0.193	0.0128	718	-------	2.14
OP#2	1716	63	250	0	738	360	195	0.0518	1671	0.1932	0.0138	720	-------	0.6
OP#3	1415	78	0	385	469	0	181	0.0521	1671	0.1906	0.0138	721	-------	1.65
1768	2068	0	0	0	0	534	231	0.053	1670	0.193	0.013	451	------	------
OP#1	1843	0	0	0	0	0	250	0.0546	1670	0.1978	0.0126	471	-------	10.12
OP#2	2195	0	2000	0	0	0	239	0.0544	1665	0.1866	0.013	454	-------	11.6
OP#3	2114	250	0	541	313	0	247	0.0532	1670	0.169	0.0105	453	-------	13.47
1769	2001	0	2002	0	0	0	214	0.048	1677	0.179	0.016	744	------	------
OP#1	2038	44	999	0	0	0	249	0.0473	1676	0.1773	0.013	744	-------	3.01
OP#2	2195	0	373	0	0	0	236	0.0484	1673	0.1769	0.0132	745	-------	6
OP#3	2090	0	4	22	0	0	236	0.0475	1676	0.1791	0.0135	740	-------	2.21
1770	2117	0	0	0	0	1	233	0.054	1669	0.186	0.012	454	------	------
OP#1	1823	0	0	0	0	0	250	0.0542	1664	0.1806	0.0099	479	-------	13.67
OP#2	1936	0	170	0	0	0	194	0.0548	1664	0.1748	0.012	585	-------	41.29
OP#3	2278	31	0	973	0	0	250	0.0544	1666	0.145	0.0065	454	-------	26.12
1771	1510	0	0	0	0	0	220	0.053	1666	0.163	0.011	712	------	------
OP#1	1525	127	497	0	0	0	237	0.05	1666	0.1632	0.0091	712	-------	5.76
OP#2	1589	31	373	0	5	180	198	0.0535	1666	0.1627	0.0103	712	-------	1.17
OP#3	1410	0	1496	0	0	0	216	0.0523	1663	0.1631	0.0106	710	-------	4.22
1777	1929	0	2003	0	0	499	206	0.059	1656	0.16	0.013	513	------	------
OP#1	1792	0	0	0	0	0	236	0.0536	1661	0.1899	0.0106	544	-------	40.27
OP#2	1997	0	983	0	0	950	250	0.0583	1651	0.1747	0.0099	514	-------	15.54
OP#3	1982	7	1249	957	98	0	214	0.0569	1656	0.1603	0.0091	512	-------	3.99
1778	2079	0	0	0	0	1027	229	0.042	1688	0.156	0.017	959	------	------
OP#1	2674	500	407	0	0	0	219	0.0473	1695	0.1559	0.0115	960	-------	19.89
OP#2	2830	317	219	0	301	8	206	0.042	1688	0.156	0.0121	958	-------	0.24
OP#3	2310	0	852	701	78	0	154	0.0416	1688	0.156	0.0128	957	-------	1.21
1780	1840	0	0	0	0	475	240	0.049	1658	0.178	0.012	500	------	------
OP#1	1723	2	0	0	0	0	245	0.0542	1663	0.1783	0.0098	498	-------	16.45
OP#2	1726	0	2000	0	0	0	167	0.0551	1656	0.1749	0.0119	506	-------	17.9
OP#3	1726	375	0	73	76	0	250	0.0509	1658	0.1656	0.0096	498	-------	11.21
1783	1950	0	1924	0	0	500	210	0.051	1639	0.141	0.008	803	------	------
OP#1	2073	498	0	0	0	0	250	0.0463	1651	0.1486	0.008	816	-------	27.78
OP#2	2209	422	1261	0	93	47	250	0.0495	1639	0.141	0.0071	803	-------	3.02
OP#3	2173	0	4	516	1720	0	236	0.0467	1639	0.1269	0.008	691	-------	33.5
1784	1749	0	0	0	0	0	234	0.049	1648	0.172	0.011	585	------	------
OP#1	1672	68	110	0	0	0	250	0.0507	1648	0.167	0.0092	585	-------	6.41
OP#2	1726	0	2000	0	0	0	178	0.0508	1643	0.1584	0.0105	586	-------	16.5
OP#3	1723	249	0	1	0	0	248	0.0494	1648	0.1556	0.0102	586	-------	10.59
1789	1689	0	0	0	0	0	240	0.043	1673	0.153	0.008	561	------	------
OP#1	1958	139	0	0	0	0	250	0.0444	1687	0.138	0.008	723	-------	59.36
OP#2	1955	0	2000	0	0	0	234	0.0499	1670	0.1382	0.008	711	-------	55.21
OP#3	1726	374	0	349	0	0	250	0.0441	1669	0.1255	0.0066	579	-------	28.13
1791	1718	0	0	218	0	49	239	0.059	1677	0.168	0.01	398	------	------
OP#1	1471	0	0	0	0	0	250	0.0535	1672	0.1957	0.0106	493	----P--	115.37
OP#2	1850	0	1908	0	0	547	250	0.0566	1667	0.1707	0.01	559	-T-----	103.48
OP#3	2004	0	0	1095	0	0	250	0.056	1672	0.1556	0.0065	422	-------	23.56
1792	2018	0	0	0	0	0	233	0.053	1688	0.17	0.012	696	------	------
OP#1	2195	250	307	0	0	0	250	0.0495	1688	0.1694	0.0114	696	-------	7.18
OP#2	2349	0	0	0	0	231	236	0.0509	1682	0.1724	0.012	692	-T-----	23.06
OP#3	2185	0	1470	123	27	0	238	0.0492	1688	0.1701	0.0113	693	-------	7.7

1793	1756	0	0	0	0	0	244	0.056	1671	0.185	0.013	601	------	------
OP#1	1762	0	360	0	0	0	242	0.0516	1671	0.1937	0.0121	600	-------	12.85
OP#2	2021	0	970	0	0	235	250	0.0548	1667	0.1876	0.0122	600	-------	7.33
OP#3	1899	1	1437	4	252	0	247	0.0543	1671	0.1851	0.0123	599	-------	3.53
1795	2287	0	1989	0	0	0	228	0.041	1683	0.153	0.017	962	------	------
OP#1	2427	470	0	0	0	0	223	0.0437	1686	0.1542	0.0113	961	-------	10.31
OP#2	2664	308	57	0	0	0	245	0.0411	1683	0.1503	0.0118	964	-------	2.18
OP#3	2087	14	1365	140	76	0	183	0.041	1683	0.153	0.0143	962	-------	0.05
1801	2235	494	0	0	0	0	224	0.048	1688	0.144	0.01	1058	------	------
OP#1	2097	344	379	0	0	0	250	0.0408	1683	0.1424	0.01	911	C------	74.86
OP#2	2332	0	29	0	10	278	250	0.0405	1683	0.1314	0.01	1022	C------	45.33
OP#3	1975	0	1971	536	0	0	202	0.0395	1676	0.1173	0.01	895	CT-----	174.71
1803	2610	502	1267	0	0	0	220	0.034	1679	0.118	0.011	1165	------	------
OP#1	2796	236	0	0	0	0	186	0.0361	1691	0.1179	0.0102	1166	-------	18.81
OP#2	2852	31	500	0	621	47	247	0.034	1679	0.1181	0.009	1162	-------	0.61
OP#3	2378	0	156	705	0	0	180	0.0341	1677	0.1178	0.011	1020	-------	15.16
1804	1750	498	0	0	0	0	229	0.044	1684	0.143	0.009	983	------	------
OP#1	2036	500	0	0	0	0	250	0.0391	1697	0.1317	0.0097	959	----P--	110.16
OP#2	2195	293	774	0	22	680	250	0.0409	1680	0.1264	0.009	983	-------	22.28
OP#3	1843	0	0	1054	0	0	192	0.0412	1683	0.123	0.009	825	-------	37.26
1806	2296	503	0	0	0	0	207	0.045	1687	0.13	0.009	875	------	------
OP#1	2273	500	6	0	0	0	247	0.0441	1690	0.132	0.009	873	-------	6.53
OP#2	2461	0	0	0	37	250	250	0.045	1685	0.1299	0.0089	873	-------	2.3
OP#3	2158	11	1500	218	154	0	236	0.043	1687	0.13	0.009	787	-------	14.57
1808	2455	0	0	495	0	0	248	0.053	1664	0.177	0.01	721	------	------
OP#1	2280	500	0	0	0	0	244	0.0523	1669	0.1777	0.01	721	-------	6.63
OP#2	2349	51	25	0	613	547	213	0.0531	1660	0.1581	0.01	721	-------	15.4
OP#3	2197	0	4	766	93	0	197	0.0521	1664	0.16	0.01	663	-------	21.08
1809	2553	0	0	0	0	0	209	0.052	1668	0.139	0.011	916	------	------
OP#1	2525	125	27	0	0	0	187	0.0467	1666	0.1537	0.0109	916	-------	22.81
OP#2	2662	0	0	0	0	497	234	0.045	1664	0.1497	0.0102	823	-------	36.64
OP#3	2432	0	2000	608	0	0	205	0.0455	1663	0.1399	0.0106	775	-------	34.46
1815	2000	0	0	0	0	0	215	0.044	1686	0.128	0.01	868	------	------
OP#1	2038	7	12	0	0	0	202	0.044	1686	0.1337	0.009	868	-------	4.66
OP#2	2038	0	282	0	0	0	195	0.0445	1683	0.128	0.0095	917	-------	9.65
OP#3	1982	5	561	34	0	0	233	0.0403	1685	0.1281	0.0088	866	-------	10.02
1828	1498	0	0	0	0	1200	187	0.057	1632	0.164	0.012	719	------	------
OP#1	1396	5	10	0	0	0	197	0.0524	1632	0.1697	0.0112	720	-------	11.72
OP#2	1843	250	194	0	863	372	249	0.053	1632	0.1636	0.0098	720	-------	7.41
OP#3	1669	0	10	372	2168	0	206	0.0526	1632	0.1494	0.012	682	-------	22.97
1832	1484	0	0	515	0	0	208	0.047	1670	0.141	0.012	735	------	------
OP#1	1611	8	0	0	0	0	221	0.047	1681	0.1417	0.009	734	-------	11.98
OP#2	1530	29	1300	0	252	313	149	0.0469	1670	0.141	0.011	735	-------	0.23
OP#3	1616	27	0	55	1591	0	234	0.0471	1670	0.1408	0.0092	737	-------	0.83
1833	1899	0	928	0	0	1436	249	0.048	1691	0.128	0.01	796	------	------
OP#1	2043	500	0	0	0	0	250	0.0427	1707	0.1632	0.0118	888	TMnP-	303.79
OP#2	2315	0	1750	0	0	2115	250	0.0422	1686	0.1234	0.01	814	-------	22.85
OP#3	1985	0	1498	1133	1017	0	185	0.0434	1691	0.1281	0.01	794	-------	9.91
1834	1807	0	0	187	0	1004	212	0.054	1680	0.151	0.013	916	------	------
OP#1	1845	0	2000	0	0	0	229	0.0481	1675	0.1512	0.0124	899	C------	28.5
OP#2	2251	0	0	0	623	0	250	0.0472	1677	0.1387	0.0094	916	-------	23.54
OP#3	1823	0	498	34	0	0	222	0.0476	1675	0.1513	0.0113	771	-------	32.73

1836	2138	0	0	915	0	33	247	0.054	1666	0.146	0.011	637	------	------
OP#1	2129	0	708	0	0	0	249	0.0504	1666	0.146	0.0092	636	-------	6.95
OP#2	2273	0	61	0	0	0	249	0.054	1661	0.1346	0.0082	676	-------	18.95
OP#3	2080	0	235	56	0	0	243	0.0524	1662	0.1461	0.0096	635	-------	7.72
1837	2350	0	0	951	104	0	190	0.042	1636	0.114	0.009	840	------	------
OP#1	2557	500	0	0	0	0	243	0.0463	1655	0.1439	0.0092	843	-T--P--	119.98
OP#2	2781	334	1415	0	528	806	236	0.0424	1636	0.1141	0.007	840	-------	1.11
OP#3	2632	24	0	899	2500	0	198	0.042	1640	0.1047	0.009	807	-------	18.62
1838	2358	0	0	0	0	0	189	0.037	1680	0.102	0.01	1224	------	------
OP#1	2476	493	250	0	0	0	182	0.04	1680	0.102	0.0092	1226	-------	8.37
OP#2	2696	0	0	0	667	8	243	0.037	1680	0.102	0.0078	1118	-------	8.78
OP#3	2214	0	2	753	0	0	164	0.0336	1680	0.0992	0.01	1063	-------	25.65
1839	2245	0	0	0	0	654	239	0.055	1683	0.161	0.013	633	------	------
OP#1	1965	55	14	0	0	0	223	0.0527	1683	0.1698	0.0119	633	-------	9.67
OP#2	2349	0	250	0	7	352	250	0.0524	1683	0.1611	0.012	633	-------	4.82
OP#3	1953	11	2000	346	81	0	215	0.0541	1683	0.161	0.0117	633	-------	1.65
1840	2079	0	0	0	0	1002	239	0.055	1683	0.153	0.012	607	------	------
OP#1	1958	0	39	0	0	0	234	0.051	1682	0.1727	0.0114	608	-------	20.97
OP#2	2332	0	1750	0	0	106	250	0.0505	1678	0.1582	0.0113	634	-------	21.17
OP#3	2175	0	1312	457	88	0	240	0.0515	1683	0.1531	0.0101	607	-------	6.53
1841	2133	0	0	514	0	0	210	0.058	1659	0.169	0.011	555	------	------
OP#1	1794	60	0	0	0	0	226	0.0561	1659	0.1924	0.0109	556	-------	17.49
OP#2	2153	48	827	0	130	493	248	0.0575	1659	0.1691	0.0106	555	-------	1.03
OP#3	1960	0	0	844	34	0	198	0.0576	1659	0.169	0.0107	556	-------	0.95
1844	2541	0	0	0	0	0	214	0.045	1663	0.126	0.011	833	------	------
OP#1	2662	1	0	0	0	0	202	0.0455	1673	0.1284	0.0096	833	-------	12.67
OP#2	2346	0	0	0	310	0	160	0.0449	1658	0.1223	0.011	823	-------	8.93
OP#3	2344	0	248	168	0	0	211	0.0444	1663	0.126	0.0109	835	-------	1.8
1845	1798	0	0	0	0	0	210	0.044	1667	0.134	0.011	817	------	------
OP#1	1914	15	0	0	0	0	216	0.044	1675	0.1341	0.0103	815	-------	8.03
OP#2	2190	0	1427	0	626	0	250	0.044	1665	0.134	0.0098	817	-------	1.78
OP#3	2002	0	8	103	1818	0	235	0.0439	1667	0.1302	0.011	794	-------	6.31
1846	2124	0	0	0	0	0	211	0.043	1680	0.129	0.009	1011	------	------
OP#1	2351	500	8	0	0	0	243	0.0424	1682	0.1282	0.009	921	-------	13.15
OP#2	2664	250	500	0	362	0	250	0 0391	1676	0.1212	0.009	1011	-------	19.08
OP#3	2334	0	1013	838	0	0	202	0.04	1680	0.1065	0.009	848	-------	41.44
1847	2386	0	0	0	0	0	211	0.046	1663	0.099	0.009	1040	------	------
OP#1	2471	291	1376	0	0	0	238	0.0411	1663	0.099	0.0086	1040	-------	10.67
OP#2	2547	0	0	0	46	0	250	0.0422	1658	0.0953	0.0063	952	-------	25.26
OP#3	2263	0	845	174	0	0	222	0.0395	1658	0.0986	0.009	892	-------	37.32
1848	1847	0	0	0	0	0	211	0.049	1664	0.138	0.01	900	------	------
OP#1	1921	458	653	0	0	0	241	0.0467	1664	0.138	0.0097	899	-------	4.77
OP#2	2163	63	0	0	623	0	250	0.0487	1664	0.1346	0.0094	891	-------	4.31
OP#3	1924	0	98	564	0	0	208	0.0465	1664	0.1278	0.01	758	-------	30
1851	2087	0	0	0	0	521	197	0.047	1639	0.129	0.01	884	------	------
OP#1	2341	500	0	0	0	0	244	0.0455	1652	0.1291	0.01	856	-------	19.11
OP#2	2525	161	63	0	1219	27	248	0.0448	1639	0.1292	0.0097	885	-------	4.97
OP#3	2293	1	2	1217	1249	0	182	0.0469	1639	0.1019	0.01	730	-------	39.45
1852	1785	0	0	0	0	194	217	0.05	1654	0.151	0.012	843	------	------
OP#1	1752	0	700	0	0	0	209	0.0477	1654	0.1511	0.0118	841	-------	5.37
OP#2	2070	125	0	0	613	0	250	0.0483	1654	0.1498	0.011	843	-------	4.13
OP#3	1723	0	0	958	0	0	166	0.0491	1650	0.1329	0.012	767	-------	26.45

1853	2160	0	0	0	0	0	202	0.042	1674	0.118	0.011	1104	------	------
OP#1	2327	423	1998	0	0	0	248	0.0419	1674	0.1181	0.0106	1102	------	------
OP#2	2508	0	0	0	545	0	250	0.0415	1669	0.1136	0.008	994	-------	0.4
OP#3	2163	0	352	131	5	0	207	0.0383	1674	0.1179	0.011	955	-------	19.46
1854	3303	0	0	0	0	605	234	0.033	1677	0.091	0.012	1336	------	22.83
OP#1	3600	384	0	0	0	0	140	0.039	1683	0.0939	0.0097	1337	C------	------
OP#2	3600	23	0	0	467	55	211	0.03	1676	0.0912	0.0084	1174	-------	50.09
OP#3	2979	0	1945	731	0	0	141	0.03	1674	0.091	0.0114	1183	-------	22.53
1858	3000	0	1481	0	0	0	213	0.038	1686	0.09	0.01	1320	------	23.91
OP#1	3339	469	0	0	0	0	160	0.0374	1686	0.0997	0.01	1325	-------	------
OP#2	3453	0	0	0	39	106	249	0.0312	1684	0.09	0.0086	1158	-------	13.58
OP#3	3004	0	1666	701	0	0	183	0.0298	1681	0.0834	0.01	1086	-----O-	31.86
1859	2350	0	0	0	0	0	206	0.04	1691	0.152	0.014	1098	------	111.25
OP#1	2234	500	1697	0	0	0	243	0.0429	1691	0.1499	0.0139	1096	-------	------
OP#2	2664	0	0	0	1400	0	250	0.0372	1688	0.1461	0.0125	1092	-------	9
OP#3	2143	0	1001	245	626	0	195	0.0398	1691	0.1422	0.014	944	-------	14.69
1862	2319	0	2002	0	0	0	249	0.048	1668	0.125	0.009	982	------	21.1
OP#1	2381	370	1369	0	0	0	249	0.0434	1664	0.1174	0.009	980	-------	------
OP#2	2557	0	0	0	37	0	250	0.0434	1663	0.1045	0.0066	927	-------	19.84
OP#3	2251	0	1501	23	0	0	233	0.0415	1663	0.1084	0.009	849	-------	36.5
1863	1884	0	1996	0	0	1412	237	0.046	1653	0.123	0.009	922	------	48.65
OP#1	1723	500	0	0	0	0	250	0.0431	1666	0.1451	0.0095	881	----P--	------
OP#2	1985	125	0	0	618	1627	250	0.0443	1653	0.123	0.0084	920	-------	95.8
OP#3	1882	0	0	1051	1874	0	198	0.0438	1654	0.111	0.0089	766	-------	4.17
1864	1799	0	0	0	0	0	206	0.045	1669	0.134	0.011	923	------	31.99
OP#1	1696	125	0	0	0	0	195	0.0446	1669	0.1374	0.0107	924	-------	------
OP#2	2031	94	0	0	340	653	250	0.0449	1669	0.134	0.0104	922	-------	3.58
OP#3	1882	0	313	175	1127	0	239	0.0441	1669	0.1341	0.0109	772	-------	0.28
1865	1687	0	0	0	0	0	227	0.053	1660	0.116	0.008	922	------	18.57
OP#1	1489	438	22	0	0	0	209	0.0479	1656	0.1287	0.008	921	-------	------
OP#2	1870	4	500	0	655	575	250	0.0504	1660	0.116	0.0068	922	-------	24.91
OP#3	1410	78	2000	656	0	0	190	0.0466	1655	0.1076	0.008	758	-------	4.9
1866	2139	0	1994	0	0	0	232	0.047	1679	0.116	0.007	985	------	47.48
OP#1	2156	375	1374	0	0	0	247	0.0439	1674	0.1065	0.007	981	-------	------
OP#2	2205	0	0	0	0	0	227	0.047	1674	0.097	0.0055	1018	-------	19.86
OP#3	2036	0	0	0	0	0	248	0.0406	1668	0.1139	0.0064	831	-T-----	24.75
1871	1864	0	0	0	0	0	181	0.043	1661	0.102	0.005	891	------	101.82
OP#1	2016	407	0	0	0	0	232	0.0442	1676	0.102	0.0048	893	-------	------
OP#2	1921	281	1752	0	37	0	195	0.0478	1661	0.1012	0.005	891	-------	18
OP#3	1762	6	0	854	76	0	193	0.043	1661	0.099	0.005	814	-------	11.99
1876	2098	0	0	0	0	701	233	0.052	1667	0.129	0.007	624	------	11.85
OP#1	2114	438	0	0	0	0	250	0.0469	1672	0.1348	0.007	783	-------	------
OP#2	2156	0	1750	0	0	0	249	0.0524	1662	0.1274	0.0069	679	-------	45.32
OP#3	2036	0	0	643	0	0	231	0.0504	1663	0.128	0.007	623	-------	15.81
1879	1900	0	0	0	0	0	147	0.044	1679	0.135	0.01	1071	------	8.06
OP#1	2012	344	0	0	0	0	177	0.0446	1682	0.1351	0.0098	1072	-------	------
OP#2	2227	3	0	0	1549	0	229	0.044	1677	0.1333	0.009	1071	-------	4.13
OP#3	1706	0	1005	851	0	0	154	0.0433	1675	0.1197	0.01	909	-------	3.09
1883	1706	0	0	0	0	0	149	0.039	1684	0.095	0.007	1355	------	32.15
OP#1	2273	500	0	0	0	0	216	0.0338	1700	0.0948	0.008	1193	----P--	------
OP#2	2300	0	0	0	821	1001	250	0.0359	1681	0.0949	0.0069	1193	-------	188.23
OP#3	2036	0	1947	879	626	0	195	0.0325	1684	0.0734	0.007	987	-----O-	23.35

1886	1575	0	0	965	1373	0	229	0.057	1636	0.121	0.005	427	------	------
OP#1	1317	167	0	0	0	0	250	0.0517	1652	0.1513	0.0068	588	----P--	449.56
OP#2	1415	0	2000	0	0	1498	243	0.0611	1634	0.1211	0.0046	468	-------	19.33
OP#3	1405	65	0	1141	626	0	215	0.059	1636	0.121	0.005	429	-------	3.89
1889	1905	0	0	0	0	1378	152	0.051	1699	0.171	0.018	989	------	------
OP#1	1965	42	57	0	0	0	140	0.0507	1699	0.1745	0.0145	989	-------	2.73
OP#2	2515	163	18	0	995	653	245	0.0463	1699	0.1713	0.0128	988	-------	9.45
OP#3	1709	0	2000	526	274	0	140	0.0446	1699	0.177	0.0149	963	-------	19.25
1890	1798	0	0	578	0	0	233	0.06	1659	0.154	0.007	459	------	------
OP#1	1452	0	0	0	0	0	250	0.0552	1658	0.1622	0.007	460	-------	15.02
OP#2	1647	0	1730	0	0	0	236	0.0622	1654	0.1514	0.007	536	-------	27.12
OP#3	1603	0	749	302	0	0	250	0.0584	1654	0.1541	0.0066	483	-------	13.25
1891	1810	0	0	916	2095	0	143	0.041	1634	0.106	0.012	990	------	------
OP#1	2036	464	0	0	0	0	160	0.0477	1649	0.1292	0.0089	1120	C------	99.29
OP#2	2109	500	874	0	899	1279	143	0.041	1634	0.106	0.0069	991	-------	0.4
OP#3	1625	127	2000	435	2422	0	140	0.0409	1634	0.106	0.0106	989	-------	0.37
1894	1925	0	0	594	284	0	229	0.045	1671	0.138	0.01	720	------	------
OP#1	1990	67	0	0	0	0	223	0.0485	1678	0.138	0.0082	719	-------	14.44
OP#2	1999	0	1750	0	0	0	195	0.0499	1670	0.1379	0.0099	730	-------	13.2
OP#3	1999	49	0	370	218	0	228	0.0463	1671	0.1381	0.0086	718	-------	3.22
1896	2096	0	2003	0	0	551	224	0.051	1662	0.15	0.008	584	------	------
OP#1	2036	496	0	0	0	0	250	0.0498	1676	0.1562	0.0088	746	----P--	147.02
OP#2	2104	1	1711	0	0	1267	248	0.0557	1658	0.1366	0.008	584	-------	21.97
OP#3	2065	68	0	691	1210	0	230	0.0509	1662	0.1421	0.008	585	-------	7.17
1897	1670	0	0	0	0	0	150	0.044	1638	0.063	0.007	1141	------	------
OP#1	1799	16	0	0	0	0	140	0.0422	1640	0.0654	0.0051	1141	-------	9.7
OP#2	2231	97	1022	0	1405	59	250	0.0401	1638	0.0631	0.0011	1140	-------	9.09
OP#3	1596	4	1625	382	932	0	174	0.0381	1637	0.063	0.007	1006	-------	27.18
1898	2228	0	2003	0	0	528	228	0.051	1667	0.126	0.007	607	------	------
OP#1	1943	126	0	0	0	0	250	0.05	1679	0.1321	0.007	608	-------	18.53
OP#2	2021	4	1900	0	0	250	243	0.0562	1664	0.1254	0.007	607	-------	13.83
OP#3	1906	63	839	323	626	0	242	0.0509	1666	0.1261	0.0069	605	-------	1.7
1900	2592	0	2001	0	0	2518	216	0.046	1610	0.092	0.006	541	------	------
OP#1	2877	147	0	0	0	0	250	0.0456	1664	0.1224	0.0077	703	-T--P--	793.62
OP#2	2366	184	1937	0	29	2628	155	0.0469	1610	0.0919	0.0059	541	-------	1.99
OP#3	2542	345	63	1037	2500	0	221	0.046	1621	0.0919	0.006	541	-------	11.15
1903	1725	0	0	0	0	0	150	0.044	1706	0.118	0.009	1364	------	------
OP#1	2222	500	0	0	0	0	179	0.0404	1721	0.1068	0.0099	1203	----P--	140.09
OP#2	2515	114	4	0	2065	35	250	0.0396	1706	0.1181	0.0083	1306	-------	14.34
OP#3	1687	0	970	1065	78	0	142	0.0377	1705	0.1121	0.009	1007	-----O-	189.62
1905	2369	0	2001	907	0	0	228	0.06	1647	0.123	0.004	364	------	------
OP#1	2349	5	0	0	0	0	250	0.0519	1660	0.156	0.0072	526	CMnP	980.21
OP#2	2302	0	1783	0	0	1001	250	0.0597	1634	0.1239	0.0038	525	-T-----	137.48
OP#3	2349	16	1496	958	0	0	250	0.0568	1642	0.123	0.0037	420	-------	25.97
1907	1955	0	0	0	0	0	200	0.042	1708	0.144	0.014	1069	------	------
OP#1	2178	494	2000	0	0	0	249	0.0447	1708	0.1322	0.0111	1069	-------	14.72
OP#2	2317	0	0	0	584	0	195	0.042	1705	0.1245	0.01	1067	-------	16.66
OP#3	1845	0	31	0	2	0	181	0.0363	1705	0.1439	0.0114	1070	-------	16.17
1828	1498	0	0	0	0	1200	187	0.057	1632	0.164	0.012	719	------	------
OP#1	1396	5	10	0	0	0	197	0.0524	1632	0.1697	0.0112	720	-------	11.72
OP#2	1843	250	194	0	863	372	249	0.053	1632	0.1636	0.0098	720	-------	7.41
OP#3	1669	0	10	372	2168	0	206	0.0526	1632	0.1494	0.012	682	-------	22.97

1909	1547	0	0	995	815	124	229	0.06	1678	0.144	0.008	406	------	------
OP#1	1332	154	0	0	0	0	250	0.0538	1693	0.1837	0.0102	543	CMn	447.47
OP#2	1635	51	2000	0	0	1994	250	0.0603	1673	0.1415	0.008	521	-------	35.55
OP#3	1586	19	2000	844	1139	0	246	0.059	1678	0.1441	0.0058	407	-------	1.92
1910	1601	0	0	0	0	258	164	0.06	1687	0.188	0.013	761	------	------
OP#1	1476	0	244	0	0	0	180	0.0547	1684	0.1883	0.013	762	-------	11.89
OP#2	1928	282	125	0	396	117	248	0.057	1687	0.1881	0.0118	761	-------	5.04
OP#3	1352	0	2000	99	0	0	188	0.0536	1687	0.1899	0.013	745	-------	13.91
1912	1806	0	0	0	0	584	166	0.058	1673	0.171	0.015	628	------	------
OP#1	1723	1	686	0	0	0	221	0.056	1672	0.1717	0.0112	629	-------	4.95
OP#2	1862	78	6	0	188	0	195	0.0578	1673	0.1705	0.0122	628	-------	0.79
OP#3	1772	0	585	185	132	0	219	0.0553	1673	0.171	0.0108	629	-------	4.87
1913	1735	0	0	0	0	999	225	0.055	1652	0.137	0.007	445	------	------
OP#1	1508	250	0	0	0	0	250	0.0525	1669	0.1772	0.0095	603	TMnP-	543.15
OP#2	1647	0	1906	0	0	2002	234	0.0591	1647	0.1335	0.0065	477	-------	22.29
OP#3	1647	144	0	1006	1249	0	228	0.0554	1653	0.1371	0.0059	443	-------	1.81
1914	1798	0	0	0	0	1026	174	0.06	1677	0.201	0.018	714	------	------
OP#1	1413	33	504	0	0	0	197	0.056	1677	0.2099	0.0149	713	-------	11.28
OP#2	1980	235	516	0	838	344	250	0.0559	1677	0.2011	0.0131	714	-------	6.96
OP#3	1405	11	999	356	938	0	175	0.0552	1677	0.2013	0.0145	713	-------	8.69
1915	1986	0	0	0	0	0	184	0.053	1675	0.187	0.016	968	------	------
OP#1	2004	497	2000	0	0	0	248	0.05	1671	0.1795	0.0136	969	-------	13.96
OP#2	2349	0	0	0	1083	0	250	0.05	1670	0.1688	0.0106	884	-------	28.56
OP#3	1726	0	0	0	0	0	172	0.0467	1673	0.1869	0.0151	916	-------	19.02
1917	2239	499	0	0	0	1135	174	0.053	1670	0.131	0.01	657	------	------
OP#1	1831	141	4	0	0	0	223	0.053	1676	0.1596	0.0088	656	-------	27.57
OP#2	2200	31	1840	0	37	626	233	0.0531	1670	0.1309	0.0067	658	-------	0.6
OP#3	2041	3	1500	450	1559	0	234	0.0495	1670	0.1311	0.0063	656	-------	7
1918	1711	0	0	0	0	0	223	0.05	1691	0.2	0.012	495	------	------
OP#1	1936	0	0	0	0	0	250	0.0495	1691	0.206	0.014	572	----P--	185.67
OP#2	2258	0	1279	0	0	2002	250	0.0499	1671	0.1692	0.012	657	-T-----	218.87
OP#3	2195	93	0	687	0	0	250	0.0502	1686	0.1871	0.0114	539	-------	20.71
1919	1849	498	0	0	0	1192	168	0.046	1689	0.13	0.01	1037	------	------
OP#1	1968	500	0	0	0	0	229	0.0456	1704	0.1496	0.01	910	-------	43.69
OP#2	2310	63	250	0	1373	997	250	0.0457	1689	0.1302	0.0082	1036	-------	0.99
OP#3	1638	2	999	1081	604	0	140	0.0432	1689	0.13	0.0098	914	-------	17.86
1923	2476	496	0	0	0	1248	177	0.05	1671	0.158	0.01	761	------	------
OP#1	2129	500	0	0	0	0	250	0.0513	1686	0.1855	0.0109	719	----P--	131.85
OP#2	2400	110	1892	0	762	512	222	0.0499	1671	0.158	0.0092	762	-------	0.25
OP#3	1933	2	1500	738	1327	0	178	0.0493	1671	0.1581	0.01	760	-------	1.55
1924	1854	0	0	0	0	558	213	0.058	1629	0.152	0.007	388	------	------
OP#1	1413	2	0	0	0	0	250	0.0523	1630	0.1548	0.008	518	C---P--	197.21
OP#2	1667	0	1666	0	0	500	250	0.0577	1624	0.1446	0.007	471	-------	31.64
OP#3	1706	125	23	783	24	0	249	0.0578	1629	0.1332	0.007	386	-------	13.18
1926	1806	0	0	849	0	0	221	0.05	1675	0.181	0.011	450	------	------
OP#1	1706	15	0	0	0	0	250	0.0506	1690	0.1858	0.0116	556	----P--	93.34
OP#2	1867	0	2000	0	0	1126	248	0.0564	1670	0.1695	0.011	545	-------	45.25
OP#3	1628	437	0	352	0	0	250	0.0502	1675	0.169	0.0098	450	-------	7.2
1927	2421	0	0	0	0	131	173	0.046	1645	0.103	0.005	755	------	------
OP#1	2535	180	2	0	0	0	237	0.046	1654	0.1083	0.005	757	-------	14.42
OP#2	2273	0	506	0	0	0	187	0.049	1641	0.103	0.0049	784	-------	14.76
OP#3	2332	0	0	701	0	0	218	0.0451	1641	0.0997	0.005	739	-------	11.33

1929	2076	0	0	0	0	482	174	0.05	1643	0.138	0.008	773	------	------
OP#1	2063	294	8	0	0	0	235	0.0477	1643	0.1532	0.008	773	-------	15.73
OP#2	2122	0	874	0	0	0	221	0.05	1642	0.1379	0.0072	773	-------	0.95
OP#3	2114	0	29	394	0	0	238	0.0475	1642	0.138	0.008	687	-------	17.09
1931	1963	0	0	0	0	112	173	0.041	1677	0.152	0.013	1057	------	------
OP#1	2141	500	2000	0	0	0	249	0.0454	1677	0.1483	0.012	1059	-------	13.26
OP#2	2332	63	49	0	743	0	195	0.041	1677	0.1413	0.0108	1058	-------	7.26
OP#3	1892	0	0	271	0	0	167	0.0386	1677	0.151	0.013	1032	-------	9.67
1932	1874	0	0	0	0	282	178	0.042	1647	0.109	0.008	982	------	------
OP#1	2117	500	1674	0	0	0	250	0.0472	1652	0.1039	0.0061	982	-------	21.81
OP#2	2038	123	528	0	618	0	140	0.0438	1647	0.0853	0.0051	982	-------	26.19
OP#3	1823	0	0	0	418	0	195	0.042	1647	0.1072	0.008	939	-------	6.23
1939	2648	0	0	0	0	0	200	0.042	1666	0.13	0.01	953	------	------
OP#1	2476	445	203	0	0	0	233	0.0429	1666	0.1299	0.0089	952	-------	2.23
OP#2	2349	0	0	0	134	0	188	0.042	1661	0.1284	0.0099	931	-------	8.51
OP#3	2312	0	0	290	0	0	221	0.0402	1663	0.1289	0.01	868	-------	17.7
1943	2472	0	0	0	0	0	220	0.038	1669	0.124	0.008	976	------	------
OP#1	2420	500	272	0	0	0	240	0.0417	1669	0.124	0.0079	976	-------	9.79
OP#2	2508	2	1044	0	0	0	204	0.0381	1667	0.1131	0.008	995	-------	12.7
OP#3	2344	64	63	405	0	0	234	0.0379	1665	0.1181	0.008	835	-------	24.91
1944	2056	0	0	0	0	0	217	0.037	1696	0.159	0.013	966	------	------
OP#1	2207	484	123	0	0	0	238	0.0416	1696	0.159	0.0125	964	-------	12.52
OP#2	2508	15	999	0	12	0	229	0.037	1696	0.152	0.0127	970	-------	4.94
OP#3	2117	0	8	257	469	0	208	0.037	1696	0.1587	0.013	959	-------	1.84
1945	2826	0	0	0	0	640	199	0.034	1689	0.144	0.013	1226	------	------
OP#1	2950	500	1443	0	0	0	221	0.0393	1699	0.1309	0.0128	1225	-------	34.61
OP#2	2899	0	0	0	626	0	195	0.0338	1688	0.1323	0.0119	1129	-------	17.43
OP#3	2508	0	47	349	196	0	181	0.0332	1689	0.1403	0.013	1078	-------	17.32
1948	1822	0	0	0	0	709	215	0.044	1688	0.173	0.014	778	------	------
OP#1	2026	37	0	0	0	0	226	0.0443	1694	0.173	0.0129	779	-------	6.74
OP#2	2224	0	1369	0	0	125	233	0.044	1685	0.1729	0.013	779	-------	3.09
OP#3	1946	62	907	18	494	0	234	0.0439	1688	0.1728	0.0129	782	-------	0.83
1949	1737	0	0	0	0	336	174	0.056	1667	0.166	0.012	802	------	------
OP#1	1652	37	1509	0	0	0	223	0.052	1667	0.1668	0.012	803	-------	7.74
OP#2	1982	86	0	0	584	0	250	0.0557	1667	0.1583	0.0087	802	-------	5.2
OP#3	1440	3	999	101	0	0	186	0.0506	1665	0.1661	0.0117	800	-------	11.86
1953	2084	0	0	0	0	17	182	0.043	1648	0.166	0.017	816	------	------
OP#1	1936	17	1877	0	0	0	250	0.0479	1648	0.1615	0.0125	816	-------	14.12
OP#2	2048	118	295	0	78	0	168	0.043	1648	0.156	0.0118	816	-------	6.19
OP#3	1823	187	0	5	37	0	205	0.0434	1648	0.1563	0.0132	818	-------	7.04
1955	2086	0	0	0	0	0	174	0.043	1650	0.16	0.011	817	------	------
OP#1	1990	102	0	0	0	0	220	0.0448	1654	0.1601	0.0104	817	-------	8.32
OP#2	2038	116	999	0	7	0	195	0.0435	1650	0.158	0.0109	817	-------	2.37
OP#3	1985	63	63	428	547	0	211	0.043	1650	0.1446	0.011	803	-------	11.53
1957	1990	0	0	0	0	0	187	0.04	1667	0.146	0.014	1135	------	------
OP#1	2261	415	498	0	0	0	206	0.0399	1667	0.146	0.0116	1135	-------	0.48
OP#2	2349	0	4	0	357	121	219	0.0379	1667	0.1462	0.011	1057	-------	12.26
OP#3	1916	0	446	301	0	0	166	0.0356	1665	0.1461	0.014	1081	-------	17.51
1961	1763	496	0	0	0	696	180	0.041	1671	0.154	0.014	1048	------	------
OP#1	1980	391	0	0	0	0	206	0.0412	1686	0.1631	0.0139	1046	-------	21.42
OP#2	2231	390	1155	0	621	426	244	0.041	1671	0.154	0.0118	1048	-------	0.19
OP#3	1608	0	282	768	745	0	156	0.0407	1671	0.1539	0.014	959	-------	9.32

1963	2278	491	0	0	0	554	176	0.039	1650	0.127	0.014	1006	------	------
OP#1	2266	315	2	0	0	0	197	0.0436	1665	0.1487	0.0117	1006	-------	43.86
OP#2	2478	372	436	0	645	907	213	0.039	1650	0.127	0.009	1006	-------	0.09
OP#3	1865	100	567	760	1249	0	140	0.039	1651	0.127	0.0128	991	-------	2.5
1968	1753	0	0	0	0	393	224	0.046	1685	0.175	0.012	977	------	------
OP#1	1933	492	1054	0	0	0	229	0.0479	1685	0.1729	0.012	978	-------	5.42
OP#2	2036	0	0	0	1210	0	180	0.046	1681	0.165	0.0112	977	-------	9.51
OP#3	1682	0	502	70	0	0	193	0.0448	1685	0.1732	0.012	887	-------	12.99
1970	1961	0	0	0	0	0	199	0.052	1680	0.162	0.012	939	------	------
OP#1	2041	0	616	0	0	0	238	0.0446	1675	0.1636	0.012	782	C------	77.09
OP#2	2295	0	0	0	32	0	250	0.0452	1675	0.1508	0.0106	914	-------	27.68
OP#3	1960	0	248	0	0	0	236	0.0448	1671	0.162	0.0119	789	CT-----	95.64
1971	1715	0	0	0	0	0	209	0.052	1691	0.193	0.016	655	------	------
OP#1	1550	3	405	0	0	0	250	0.0476	1691	0.1929	0.0148	655	-------	8.69
OP#2	1887	0	1298	0	0	98	250	0.0493	1686	0.202	0.0157	655	-------	14.56
OP#3	1728	0	0	526	0	0	224	0.0505	1691	0.1923	0.0138	655	-------	3.62
1974	1420	0	0	0	0	0	225	0.051	1679	0.147	0.01	932	------	------
OP#1	1647	355	2	0	0	0	195	0.0484	1679	0.1481	0.01	932	-------	6.07
OP#2	2014	0	156	0	1153	59	249	0.0506	1679	0.1469	0.008	932	-------	0.82
OP#3	1410	13	999	465	10	0	176	0.0466	1679	0.147	0.01	843	-------	18.82
1978	1909	0	0	0	0	397	200	0.053	1690	0.213	0.017	921	------	------
OP#1	1958	313	1488	0	0	0	218	0.0519	1688	0.213	0.017	923	-------	4.01
OP#2	2466	0	0	0	1562	0	250	0.0487	1688	0.1995	0.0142	915	-------	16.8
OP#3	1779	0	375	0	547	0	178	0.0487	1690	0.2129	0.017	865	-------	14.21
1979	2126	0	0	0	0	0	204	0.044	1698	0.208	0.014	501	------	------
OP#1	2078	0	0	0	0	0	250	0.0484	1699	0.2078	0.0159	594	----P--	164.13
OP#2	2349	0	762	0	0	2440	250	0.0485	1673	0.1776	0.014	642	-T-----	279.74
OP#3	2293	312	0	688	0	0	250	0.0447	1693	0.183	0.0126	549	-------	28.16
1982	1717	0	0	0	0	0	197	0.056	1671	0.201	0.015	672	------	------
OP#1	1567	0	1421	0	0	0	249	0.0526	1666	0.2013	0.0134	671	-------	10.94
OP#2	1872	0	12	0	78	0	245	0.056	1671	0.1875	0.0115	672	-------	7.24
OP#3	1726	0	0	0	32	0	236	0.0525	1671	0.1898	0.0119	658	-------	14.06
1983	1724	0	0	0	0	1	207	0.057	1697	0.202	0.013	398	------	------
OP#1	1723	0	0	0	0	0	250	0.0529	1696	0.2088	0.0141	505	----P--	126.06
OP#2	2036	0	1265	0	0	809	250	0.0562	1682	0.1948	0.013	532	-T-----	148.31
OP#3	2034	0	0	911	0	0	250	0.0563	1692	0.1922	0.0095	441	-------	21.82
1984	1831	0	0	293	0	0	201	0.046	1681	0.155	0.008	737	------	------
OP#1	2117	500	0	0	0	0	250	0.0459	1690	0.1526	0.0082	825	----P--	47.36
OP#2	2078	0	1490	0	0	0	236	0.0521	1677	0.1471	0.008	738	-------	22.75
OP#3	2038	0	0	175	540	0	247	0.0453	1681	0.1491	0.0076	731	-------	6.26
1987	2297	0	0	0	0	0	215	0.06	1672	0.176	0.008	452	------	------
OP#1	1938	2	0	0	0	0	250	0.0548	1673	0.1931	0.0096	469	----P--	225.22
OP#2	2249	0	1937	0	0	110	250	0.0578	1667	0.1653	0.008	604	-------	48.23
OP#3	2187	0	0	765	0	0	250	0.0553	1667	0.1684	0.0064	476	-------	22.56
1989	3418	0	0	0	0	2196	168	0.043	1628	0.087	0.004	868	------	------
OP#1	3600	500	0	0	0	0	250	0.0445	1659	0.1295	0.008	853	-TMnP	1383.6
OP#2	3522	20	133	0	306	1748	248	0.043	1628	0.0871	0.0029	868	-------	0.34
OP#3	3500	0	532	1369	2493	0	225	0.0409	1628	0.087	0.004	707	-------	23.43
1991	2046	0	0	0	0	1543	211	0.047	1695	0.177	0.011	715	------	------
OP#1	2114	500	0	0	0	0	250	0.0469	1710	0.1909	0.013	805	----P--	220.16
OP#2	2429	65	2000	0	78	1486	250	0.0466	1691	0.155	0.011	774	-------	25.25
OP#3	2102	2	31	701	1239	0	219	0.0467	1695	0.177	0.0109	708	-------	1.81

1993	2502	0	0	0	0	0	187	0.044	1635	0.117	0.008	957	------	------
OP#1	2632	395	111	0	0	0	223	0.0432	1635	0.1321	0.0079	956	------	------
OP#2	2779	0	0	0	313	0	250	0.0415	1635	0.117	0.006	941	-------	14.95
OP#3	2625	0	0	887	0	0	209	0.0416	1633	0.1055	0.008	797	-------	7.57
1997	1695	0	0	0	0	0	202	0.039	1685	0.165	0.012	1077	------	------
OP#1	2021	497	127	0	0	0	197	0.0441	1691	0.1651	0.0117	1076	-------	18.76
OP#2	2195	117	749	0	1259	0	183	0.039	1685	0.1562	0.0115	1079	-------	5.6
OP#3	1682	52	125	794	171	0	140	0.039	1685	0.1481	0.012	1004	-------	17.08
1998	2298	0	0	677	0	0	217	0.057	1672	0.186	0.012	416	------	------
OP#1	1882	0	0	0	0	0	250	0.0544	1673	0.2148	0.0128	474	----P--	101.99
OP#2	2224	0	2000	0	0	94	250	0.0558	1667	0.1883	0.012	513	-------	31.76
OP#3	2036	125	387	530	0	0	249	0.0577	1667	0.1859	0.0104	421	-------	7.45
2005	1796	0	0	736	0	0	217	0.053	1659	0.163	0.007	420	------	------
OP#1	1645	4	0	0	0	0	250	0.0491	1670	0.1829	0.0107	582	----P--	595.27
OP#2	1875	0	1877	0	0	2002	250	0.0533	1648	0.1326	0.007	581	-T-----	132.5
OP#3	1801	181	0	943	0	0	247	0.0539	1658	0.1435	0.007	417	-------	15.15
2006	2348	0	0	0	0	0	207	0.035	1689	0.095	0.007	1371	------	------
OP#1	2544	476	186	0	0	0	209	0.0342	1684	0.0949	0.007	1224	-------	18.63
OP#2	2664	0	0	0	0	0	250	0.0334	1684	0.0738	0.0043	1276	-------	38.73
OP#3	2195	0	1517	0	0	0	227	0.0292	1677	0.0822	0.007	1077	CT-O-	251.02
2007	1723	0	0	795	0	0	218	0.05	1670	0.154	0.008	588	------	------
OP#1	1679	226	0	0	0	0	250	0.0447	1680	0.1666	0.0105	749	----P--	372.18
OP#2	1980	0	1734	0	0	1376	250	0.0462	1665	0.1327	0.008	737	-------	51.71
OP#3	1818	8	8	854	450	0	238	0.05	1670	0.1443	0.008	583	-------	7.49
2008	1803	0	0	610	0	0	205	0.037	1669	0.12	0.007	1076	------	------
OP#1	1970	500	0	0	0	0	250	0.0415	1684	0.1335	0.0071	913	----P--	71.82
OP#2	2043	377	1672	0	628	0	168	0.0372	1669	0.1141	0.0069	1076	-------	5.47
OP#3	1789	25	0	714	1249	0	182	0.037	1669	0.1052	0.007	955	-------	23.6
2009	1763	0	0	912	1590	0	217	0.052	1675	0.153	0.008	503	------	------
OP#1	1594	308	0	0	0	0	250	0.0507	1690	0.1826	0.011	659	----P--	442.08
OP#2	1882	0	1891	0	0	2002	250	0.0552	1670	0.1403	0.0078	584	-------	35.55
OP#3	1804	78	0	906	1503	0	240	0.0525	1675	0.1515	0.0067	501	-------	2.41
2011	2273	0	0	825	1010	0	219	0.044	1677	0.163	0.011	734	------	------
OP#1	2427	500	0	0	0	0	250	0.0441	1692	0.1827	0.013	860	----P--	226.73
OP#2	2561	0	248	0	0	2002	249	0.0444	1672	0.148	0.011	806	-------	24.79
OP#3	2329	66	10	1161	626	0	194	0.0441	1676	0.1538	0.011	731	-------	7.04
2015	2324	0	0	846	211	0	202	0.035	1680	0.159	0.016	1224	------	------
OP#1	2754	500	0	0	0	0	140	0.0422	1695	0.1429	0.0129	1317	C------	107.4
OP#2	2754	86	8	0	2209	0	174	0.035	1680	0.1507	0.0123	1226	-------	5.53
OP#3	2195	0	2	1	2295	0	157	0.0349	1680	0.1589	0.0152	1153	-------	6.19
2016	1855	0	0	0	0	0	199	0.046	1661	0.151	0.011	942	------	------
OP#1	1755	440	622	0	0	0	233	0.0456	1661	0.151	0.0109	941	-------	0.91
OP#2	2148	0	0	0	1249	0	250	0.0445	1661	0.1408	0.009	934	-------	10.88
OP#3	1726	0	0	701	716	0	177	0.0451	1661	0.1277	0.0109	841	-------	28.24
2017	2703	0	0	954	547	0	224	0.04	1682	0.138	0.008	941	------	------
OP#1	2779	500	0	0	0	0	250	0.0443	1697	0.1607	0.0121	856	----P--	557.9
OP#2	3143	1	1118	0	0	2264	250	0.0383	1677	0.0951	0.008	952	-------	41.42
OP#3	2899	0	0	1358	1105	0	209	0.0383	1682	0.1173	0.008	792	-------	34.98
2019	2553	0	0	935	580	0	229	0.046	1662	0.156	0.007	671	------	------
OP#1	2578	500	0	0	0	0	250	0.047	1677	0.1559	0.009	802	----P--	325.93
OP#2	2664	78	2000	0	0	485	250	0.049	1659	0.1326	0.007	717	-------	31.18
OP#3	2586	0	0	801	1251	0	234	0.046	1661	0.1331	0.0069	670	-------	15.38

2023	2361	0	0	0	0	0	226	0.044	1662	0.146	0.007	560	------	------
OP#1	2244	93	0	0	0	0	250	0.0436	1662	0.1331	0.0082	722	----P--	210.29
OP#2	2192	0	1761	0	0	207	249	0.0495	1643	0.1278	0.007	718	-T-----	213.82
OP#3	2454	0	0	788	0	0	249	0.0421	1657	0.1073	0.0063	702	-------	61.01
2025	1962	0	0	0	0	0	226	0.05	1660	0.169	0.009	529	------	------
OP#1	1750	0	0	0	0	0	250	0.0462	1660	0.169	0.0098	637	----P--	113.18
OP#2	1928	0	1439	0	0	0	250	0.0501	1653	0.155	0.009	690	-T-----	61.78
OP#3	1938	2	0	606	0	0	250	0.0512	1655	0.1439	0.0082	567	-------	29.69
2026	1811	0	0	115	0	0	225	0.051	1674	0.189	0.011	466	------	------
OP#1	1838	0	0	0	0	0	250	0.051	1687	0.1961	0.0123	543	----P--	147.66
OP#2	2031	0	1500	0	0	1126	250	0.0556	1669	0.1722	0.011	577	-------	46.86
OP#3	1814	336	0	413	0	0	250	0.0511	1674	0.1753	0.01	466	-------	7.74
2028	1736	0	0	0	0	0	230	0.06	1694	0.205	0.014	493	------	------
OP#1	1493	0	0	0	0	0	250	0.0523	1689	0.2061	0.0134	517	C------	63.8
OP#2	1892	0	874	0	0	8	250	0.0544	1689	0.1994	0.014	589	-------	36.37
OP#3	1682	0	0	302	0	0	250	0.0576	1689	0.2028	0.0119	497	-------	10.89
2029	2562	0	0	0	0	0	229	0.055	1664	0.156	0.008	523	------	------
OP#1	2234	0	0	0	0	0	250	0.0497	1659	0.1715	0.0099	568	----P--	270.75
OP#2	2505	0	1480	0	0	676	247	0.0491	1648	0.1416	0.008	669	-T-----	171.84
OP#3	2571	0	0	784	0	0	250	0.0488	1659	0.1426	0.0079	585	-------	36.57
2030	2779	0	0	0	0	0	220	0.04	1661	0.126	0.008	1068	------	------
OP#1	2820	500	248	0	0	0	212	0.0423	1661	0.1258	0.0078	1068	-------	5.88
OP#2	2916	0	0	0	271	0	238	0.04	1661	0.1013	0.0057	1067	-------	20.21
OP#3	2762	0	2	1	626	0	249	0.036	1659	0.1132	0.008	907	-------	36.9
2037	1891	0	0	214	0	0	238	0.048	1663	0.196	0.014	519	------	------
OP#1	1584	0	0	0	0	0	250	0.0502	1658	0.1935	0.011	559	-------	18.45
OP#2	1647	0	498	0	0	0	188	0.0508	1658	0.1923	0.0139	617	-------	31.32
OP#3	1811	344	0	327	0	0	250	0.0482	1658	0.1563	0.0101	522	-------	26.3
2043	1995	0	0	0	0	0	232	0.048	1658	0.157	0.008	602	------	------
OP#1	1801	171	0	0	0	0	250	0.043	1659	0.1575	0.0096	764	----P--	239.59
OP#2	2036	0	1752	0	0	892	250	0.0442	1648	0.1358	0.008	758	-T-----	109.57
OP#3	2036	0	55	935	0	0	242	0.0481	1655	0.1317	0.008	598	-------	20.21
2045	2048	0	0	0	0	0	230	0.037	1674	0.145	0.011	737	------	------
OP#1	2117	0	0	0	0	0	250	0.0402	1678	0.1526	0.011	757	-------	20.36
OP#2	2310	0	1562	0	0	532	236	0.0383	1665	0.1443	0.011	899	-T-----	73.57
OP#3	2170	250	0	350	0	0	250	0.037	1670	0.1371	0.0107	747	-------	10.43
2048	1702	0	0	354	0	0	221	0.044	1676	0.174	0.011	728	------	------
OP#1	1696	500	0	0	0	0	250	0.0436	1678	0.1741	0.012	871	----P--	116.28
OP#2	2009	4	999	0	0	1251	250	0.044	1671	0.1514	0.011	789	-------	26.31
OP#3	1875	49	0	701	780	0	223	0.0441	1676	0.1487	0.0108	725	-------	15.25
2052	1644	0	0	961	544	0	222	0.052	1666	0.17	0.009	524	------	------
OP#1	1489	180	0	0	0	0	250	0.0478	1681	0.1923	0.0129	671	----P--	491.9
OP#2	1977	0	1760	0	0	3003	247	0.0463	1661	0.131	0.0089	685	-------	71.61
OP#3	1892	0	149	896	2309	0	248	0.052	1666	0.157	0.009	523	-------	8.17
2057	1500	0	0	0	0	690	203	0.049	1671	0.172	0.011	794	------	------
OP#1	1315	309	0	0	0	0	224	0.049	1671	0.1857	0.0109	793	-------	8.48
OP#2	1608	245	999	0	293	274	212	0.0497	1671	0.1719	0.011	794	-------	1.56
OP#3	1344	0	375	677	469	0	174	0.0483	1671	0.1588	0.011	795	-------	10.1
2058	1786	0	0	0	0	1359	228	0.047	1635	0.139	0.006	467	------	------
OP#1	1537	250	0	0	0	0	250	0.0512	1659	0.1817	0.0105	629	TMnP-	1037.1
OP#2	1765	4	2000	0	0	2753	226	0.0538	1634	0.1227	0.006	470	-------	28.01
OP#3	1787	414	0	770	2500	0	243	0.0476	1643	0 1179	0.006	467	-------	24.61

2059	2053	0	0	0	0	0	200	0.045	1675	0.135	0.01	1023	------	------
OP#1	1970	463	59	0	0	0	216	0.0421	1675	0.138	0.0099	1022	-------	8.74
OP#2	2131	0	0	0	623	0	250	0.045	1674	0.134	0.0092	1010	-------	3.32
OP#3	1882	0	0	350	0	0	217	0.0407	1674	0.1301	0.01	861	-------	29.67
2064	2250	0	0	0	0	1973	215	0.033	1660	0.134	0.01	802	------	------
OP#1	3097	500	0	0	0	0	250	0.0389	1714	0.136	0.0134	963	CT--P-	841.51
OP#2	2857	266	2000	0	156	2510	196	0.0367	1660	0.0982	0.01	801	-------	38.01
OP#3	2613	390	0	881	2500	0	206	0.0329	1675	0.1028	0.01	805	-------	39.88
2065	1697	0	0	0	0	0	202	0.054	1668	0.165	0.011	647	------	------
OP#1	1559	0	0	0	0	0	221	0.0512	1668	0.1728	0.0108	648	-------	10.12
OP#2	1870	54	626	0	115	51	242	0.0539	1668	0.1649	0.0101	647	-------	0.24
OP#3	1726	0	192	1	1134	0	244	0.052	1668	0.1651	0.0104	645	-------	3.98
2067	1537	0	0	0	0	0	214	0.041	1675	0.16	0.013	890	------	------
OP#1	1772	500	637	0	0	0	249	0.0463	1683	0.1538	0.0086	891	-------	24.52
OP#2	1726	226	1750	0	156	0	140	0.044	1675	0.1426	0.0098	891	-------	18.36
OP#3	1452	125	0	10	315	0	195	0.0417	1675	0.154	0.0102	895	-------	5.9
2069	2423	0	0	0	0	0	224	0.038	1698	0.099	0.005	890	------	------
OP#1	2710	414	0	0	0	0	250	0.0364	1698	0.0928	0.005	981	-------	20.95
OP#2	2505	0	610	0	0	0	245	0.0421	1679	0.0998	0.0046	1052	-T-----	190.55
OP#3	2491	0	751	230	0	0	250	0.0316	1685	0.0933	0.005	950	-T-----	121.23
2072	1900	0	0	0	0	1397	194	0.051	1625	0.134	0.007	825	------	------
OP#1	1958	500	0	0	0	0	250	0.0464	1640	0.1523	0.0077	815	----P--	137.41
OP#2	2085	0	500	0	1095	946	247	0.05	1625	0.1341	0.0052	824	-------	2.27
OP#3	1990	0	0	1070	1571	0	202	0.049	1625	0.1201	0.007	665	-------	33.73
2075	2558	0	0	948	0	2337	213	0.045	1641	0.112	0.008	782	------	------
OP#1	2974	498	0	0	0	0	250	0.0406	1689	0.1508	0.0104	929	-TMnP	825.64
OP#2	2798	161	1398	0	15	2983	250	0.044	1641	0.1121	0.006	782	-------	2.42
OP#3	2637	37	2000	1400	2500	0	195	0.0436	1646	0.112	0.0074	717	-------	16.65
2078	2371	0	0	882	0	0	230	0.047	1694	0.142	0.009	621	------	------
OP#1	2537	155	0	0	0	0	250	0.0417	1700	0.1606	0.0106	782	----P--	230.12
OP#2	2344	0	890	0	0	1501	236	0.0472	1667	0.1443	0.0089	782	-T-----	277.51
OP#3	2586	0	282	699	0	0	250	0.0405	1687	0.1419	0.008	737	-T-----	56.73
2079	1709	0	0	311	0	0	197	0.055	1679	0.212	0.016	788	------	------
OP#1	2041	48	2000	0	0	0	250	0.0506	1678	0.1899	0.0143	787	-------	19.31
OP#2	2349	0	0	0	350	0	249	0.0512	1677	0.1771	0.0113	788	-------	25.44
OP#3	1892	0	0	0	0	0	206	0.0493	1676	0.1939	0.0137	787	-------	22.43
2081	2041	0	0	763	0	0	215	0.044	1691	0.139	0.008	753	------	------
OP#1	2505	375	0	0	0	0	250	0.0393	1705	0.1408	0.0095	910	----P--	233.55
OP#2	2349	0	4	0	0	1533	250	0.0457	1677	0.1312	0.008	913	-T-----	132.17
OP#3	2329	0	557	594	0	0	247	0.041	1688	0.1391	0.0077	751	-------	10.47
2083	1999	0	0	0	0	1631	195	0.059	1637	0.163	0.01	669	------	------
OP#1	1972	500	0	0	0	0	250	0.0504	1652	0.194	0.0126	736	CMnP	376.89
OP#2	2173	125	500	0	467	1756	250	0.0533	1635	0.163	0.01	668	-------	12.24
OP#3	2068	0	0	1367	1229	0	201	0.0554	1637	0.1595	0.01	520	-------	30.82
2084	1604	0	0	511	0	0	209	0.06	1672	0.147	0.008	872	------	------
OP#1	1535	500	0	0	0	0	250	0.0504	1667	0.1634	0.0084	736	C---P--	172.68
OP#2	1916	0	0	0	626	215	250	0.0531	1671	0.1472	0.0074	809	-------	20.21
OP#3	1489	0	1949	597	0	0	195	0.051	1668	0.1352	0.008	708	C------	91.35
2085	2328	0	0	0	0	0	222	0.048	1648	0.126	0.004	577	------	------
OP#1	2349	250	0	0	0	0	250	0.0461	1658	0.1226	0.0049	731	----P--	256.71
OP#2	2087	2	936	0	0	16	224	0.0549	1641	0.1224	0.004	740	-T-----	74.2
OP#3	2219	0	0	573	0	0	250	0.0476	1643	0.1182	0.0039	633	-------	21.71

2086	2102	0	0	0	0	325	199	0.055	1624	0.115	0.006	818	------	------
OP#1	2019	500	0	0	0	0	250	0.0475	1629	0.145	0.0061	794	C---P--	107.69
OP#2	2163	81	282	0	149	966	250	0.0514	1624	0.115	0.0035	818	-------	6.68
OP#3	2060	0	250	963	105	0	212	0.0486	1624	0.1149	0.0059	661	-------	31.72
2088	1689	0	0	0	0	0	212	0.05	1677	0.203	0.013	809	------	------
OP#1	1804	498	498	0	0	0	235	0.0523	1677	0.1889	0.0127	809	-------	11.6
OP#2	2038	187	968	0	398	16	196	0.0512	1677	0.172	0.0125	808	-------	17.81
OP#3	1726	0	0	0	623	0	209	0.0483	1678	0.1882	0.013	795	-------	12.96
2089	1668	0	0	916	0	47	213	0.053	1685	0.2	0.01	507	------	------
OP#1	1721	6	0	0	0	0	250	0.0489	1694	0.2126	0.0143	587	----P--	473.13
OP#2	2036	0	1095	0	0	3484	250	0.0507	1663	0.1507	0.01	646	-T-----	244.07
OP#3	2082	0	59	1015	435	0	247	0.0522	1685	0.182	0.01	505	-------	11.1
2090	2070	0	0	958	0	0	212	0.054	1681	0.214	0.012	465	------	------
OP#1	1804	0	0	0	0	0	250	0.0535	1682	0.2152	0.0139	493	----P--	168.64
OP#2	2349	0	1109	0	0	1466	250	0.0505	1674	0.178	0.012	613	-T-----	82.9
OP#3	2048	156	0	519	0	0	250	0.0544	1681	0.2006	0.0117	465	-------	6.99
2092	1748	0	0	519	0	0	209	0.048	1676	0.172	0.01	814	------	------
OP#1	2273	499	0	0	0	0	250	0.0454	1689	0.1719	0.0112	834	----P--	136.01
OP#2	2395	87	2000	0	156	16	250	0.0484	1676	0.1561	0.01	815	-------	10.42
OP#3	2114	0	0	389	313	0	241	0.0476	1676	0.1681	0.01	679	-------	19.9
2093	1899	0	0	966	0	1003	218	0.047	1673	0.194	0.01	401	------	------
OP#1	1657	110	0	0	0	0	250	0.0523	1688	0.2173	0.014	557	----P--	481.26
OP#2	2036	0	1689	0	0	3152	248	0.0538	1662	0.1575	0.01	563	-T-----	145.86
OP#3	1735	500	250	643	540	0	248	0.0497	1673	0.1778	0.01	402	-------	14.41
2095	1758	0	0	940	887	0	214	0.049	1661	0.194	0.01	504	------	------
OP#1	1625	0	0	0	0	0	250	0.0478	1676	0.1954	0.0119	605	----P--	232.08
OP#2	1723	0	14	0	0	2264	250	0.0548	1654	0.1696	0.01	659	-T-----	79.24
OP#3	1611	344	125	513	156	0	243	0.049	1661	0.1709	0.01	503	-------	12.13
2096	1998	0	0	0	0	0	210	0.05	1676	0.195	0.015	897	------	------
OP#1	1980	267	929	0	0	0	228	0.0474	1676	0.195	0.0141	896	-------	5.36
OP#2	2295	63	0	0	701	0	250	0.0471	1676	0.1942	0.0131	895	-------	6.55
OP#3	1843	0	1048	11	154	0	205	0.0473	1676	0.1951	0.015	821	-------	13.93
2097	2295	0	0	0	0	518	212	0.038	1682	0.18	0.01	664	------	------
OP#1	2505	124	0	0	0	0	250	0.0395	1696	0.1645	0.0128	815	----P--	329.24
OP#2	2505	0	1750	0	0	2264	250	0.0414	1660	0.1359	0.01	826	-T-----	253.56
OP#3	2466	250	0	821	0	0	250	0.038	1678	0.144	0.01	670	-------	24.97
2098	2089	0	0	0	0	1003	201	0.056	1633	0.181	0.008	622	------	------
OP#1	1919	408	0	0	0	0	250	0.0507	1633	0.1888	0.0101	696	----P--	293.64
OP#2	2205	0	1453	0	20	798	250	0.052	1630	0.1578	0.008	622	-------	23.04
OP#3	2246	0	0	1315	364	0	209	0.0513	1633	0.1413	0.008	576	-------	37.73
2102	2260	0	0	0	0	562	209	0.046	1661	0.174	0.011	843	------	------
OP#1	2297	500	0	0	0	0	250	0.0456	1676	0.1859	0.0112	830	----P--	39.29
OP#2	2319	125	172	0	279	1067	218	0.0461	1661	0.1732	0.011	844	-------	1.61
OP#3	2202	1	0	788	1090	0	202	0.046	1661	0.171	0.011	751	-------	12.76
2103	2052	0	0	0	0	2006	196	0.049	1641	0.141	0.008	793	------	------
OP#1	2324	500	0	0	0	0	250	0.0454	1663	0.1746	0.0112	834	TMnP-	547.39
OP#2	2508	281	186	0	37	2002	250	0.0454	1641	0.1409	0.0078	794	-------	7.44
OP#3	2459	0	0	1226	2500	0	219	0.0473	1642	0.1363	0.008	631	-------	27.66
2104	2217	0	0	0	0	1298	215	0.054	1658	0.187	0.009	417	------	------
OP#1	1684	66	0	0	0	0	250	0.0531	1673	0.2171	0.0121	526	----P--	404.78
OP#2	2009	0	1906	0	0	2252	249	0.0558	1653	0.1708	0.009	541	-------	46.65
OP#3	1892	240	0	706	1092	0	249	0.0541	1658	0.1851	0.009	416	-------	1.5

2106	2565	0	0	0	0	0	210	0.04	1676	0.117	0.008	1169	------	------
OP#1	2662	500	0	0	0	0	223	0.0371	1676	0.1244	0.008	1103	-------	19.41
OP#2	2740	0	0	0	2	0	241	0.0353	1676	0.1169	0.0076	1166	-------	12.15
OP#3	2525	0	1699	300	0	0	235	0.033	1671	0.107	0.008	954	-----O-	95.15
2108	2038	0	0	0	0	0	209	0.049	1672	0.22	0.017	858	------	------
OP#1	2068	123	2000	0	0	0	248	0.0487	1672	0.2069	0.0155	860	-------	7.27
OP#2	2349	0	0	0	848	0	250	0.0486	1668	0.198	0.013	858	-------	14.77
OP#3	1882	0	0	11	0	0	188	0.0476	1670	0.2071	0.0164	858	-------	10.98
2109	2268	0	0	626	0	0	234	0.048	1684	0.158	0.011	674	------	------
OP#1	2249	304	0	0	0	0	250	0.0418	1699	0.1951	0.0133	834	C-MnP--	344.36
OP#2	2349	0	565	0	0	1865	250	0.0434	1677	0.1594	0.011	832	-T-----	65.53
OP#3	2173	0	1470	1035	0	0	216	0.0467	1683	0.158	0.0102	673	-------	3.71
2113	1913	0	0	943	2521	0	212	0.043	1669	0.144	0.008	680	------	------
OP#1	1858	500	0	0	0	0	250	0.045	1697	0.197	0.0133	842	-TMnP--	1052.26
OP#2	2156	0	2000	0	0	3058	243	0.0448	1669	0.1273	0.008	685	-------	16.79
OP#3	1884	266	2	1165	2500	0	205	0.043	1673	0.1338	0.008	646	-------	17.43
2114	1900	0	0	0	0	0	204	0.042	1658	0.153	0.009	835	------	------
OP#1	2202	500	0	0	0	0	250	0.0386	1663	0.153	0.0091	970	-------	36.38
OP#2	2156	0	1492	0	0	0	243	0.042	1653	0.1498	0.0089	867	-------	10.91
OP#3	2224	0	0	536	0	0	243	0.041	1658	0.1338	0.009	768	-------	23.21
2116	1886	0	0	0	0	2	203	0.045	1660	0.182	0.012	860	------	------
OP#1	2046	244	29	0	0	0	223	0.0448	1660	0.1853	0.012	860	-------	2.31
OP#2	2224	110	61	0	149	12	239	0.045	1660	0.182	0.0117	860	-------	0.05
OP#3	2117	0	0	438	310	0	221	0.0448	1660	0.1682	0.0119	769	-------	18.5
2120	2438	0	0	0	0	0	219	0.037	1685	0.132	0.009	1092	------	------
OP#1	2674	489	12	0	0	0	249	0.0324	1685	0.1323	0.009	1093	-------	12.76
OP#2	2725	0	0	0	0	0	250	0.0307	1680	0.125	0.0088	1229	-------	40.38
OP#3	2505	15	1992	167	0	0	250	0.0309	1676	0.1103	0.009	965	-T-----	93.35
2125	1800	0	0	0	0	0	209	0.04	1661	0.164	0.008	1227	------	------
OP#1	2334	500	0	0	0	0	245	0.0347	1674	0 1379	0.0093	1065	----P--	221.87
OP#2	2341	43	8	0	1244	250	250	0.0364	1656	0.141	0.008	1175	-------	32.16
OP#3	2195	0	1752	931	1256	0	196	0.0335	1657	0.0949	0.008	962	-----O-	169.25
2126	1900	0	0	0	0	14	197	0.045	1673	0.217	0.02	889	------	------
OP#1	2078	500	143	0	0	0	237	0.046	1673	0 2064	0.0139	889	-------	7.11
OP#2	2307	1	33	0	799	0	241	0.0451	1673	0.2036	0.0147	888	-------	6.45
OP#3	1941	0	0	0	623	0	196	0.045	1673	0.2035	0.0168	885	-------	7.07
2128	2288	0	0	0	0	0	198	0.048	1671	0.186	0.011	1048	------	------
OP#1	2583	500	0	0	0	0	249	0.043	1677	0.174	0.0114	886	----P--	78.24
OP#2	2742	0	250	0	1012	8	250	0.0418	1668	0.1629	0.011	1048	-------	28.32
OP#3	2339	0	2000	1033	0	0	170	0.0408	1665	0 1343	0.011	889	C------	92.26
2129	2141	0	0	0	0	865	209	0.045	1656	0.191	0.008	465	------	------
OP#1	1928	0	0	0	0	0	250	0.0468	1666	0.1987	0.0129	626	----P--	663.2
OP#2	2163	0	1881	0	0	2847	250	0.0482	1635	0.1442	0.008	623	-T-----	245.35
OP#3	2280	312	0	1325	83	0	247	0.0451	1656	0.139	0.0073	467	-------	28.09
2130	1894	0	0	904	0	0	200	0.047	1686	0.147	0.01	1012	------	------
OP#1	1862	499	0	0	0	0	250	0.0417	1701	0.1753	0.0133	907	----P--	381.21
OP#2	2209	171	500	0	134	2502	250	0.0411	1681	0.1256	0.01	1011	-------	32
OP#3	1882	0	1791	989	1415	0	196	0.0396	1685	0.1295	0.01	850	C------	66.08
2131	2608	0	0	689	0	0	208	0.037	1680	0.127	0.007	585	------	------
OP#1	2383	0	0	0	0	0	250	0.0403	1675	0.1531	0.0096	755	----P--	454.73
OP#2	2146	0	1863	0	0	2002	210	0.0439	1636	0.1188	0.0066	748	-T-----	487.34
OP#3	2644	3	0	959	0	0	250	0.038	1667	0.1125	0.0064	747	-T-----	138.7

2132	1827	0	0	0	0	0	194	0.05	1671	0.198	0.017	900	------	------
OP#1	1838	260	262	0	0	0	205	0.0479	1671	0.198	0.0145	899	-------	4.4
OP#2	2290	0	250	0	1305	78	250	0.0451	1671	0.1982	0.0133	899	-------	10.15
OP#3	1581	0	326	526	220	0	144	0.0477	1671	0.1979	0.0167	901	-------	4.79
2133	1772	0	0	0	0	0	206	0.05	1666	0.176	0.01	426	------	------
OP#1	1569	0	0	0	0	0	250	0.0486	1668	0.2074	0.013	589	--MnP--	370.47
OP#2	1723	0	1746	0	0	1959	250	0.0546	1645	0.1694	0.01	555	-T-----	225.43
OP#3	2041	125	0	1343	0	0	250	0.0512	1662	0.1493	0.0071	426	-------	21.65
2136	2249	0	0	0	0	0	195	0.054	1662	0.206	0.015	719	------	------
OP#1	2075	87	1120	0	0	0	248	0.0502	1661	0.2031	0.015	719	-------	9.55
OP#2	2297	0	0	0	27	0	250	0.0521	1662	0.1972	0.0139	718	-------	8.15
OP#3	2036	0	884	34	0	0	223	0.0507	1660	0.1975	0.015	717	-------	12.29
2139	2033	0	0	0	0	597	202	0.058	1657	0.225	0.014	355	------	------
OP#1	1608	0	0	0	0	0	250	0.058	1656	0.2257	0.0124	404	-------	15.64
OP#2	1850	0	1894	0	0	0	223	0.0604	1653	0.2236	0.0139	354	-------	9.18
OP#3	1662	436	0	55	0	0	250	0.058	1653	0.2116	0.0126	355	-------	10
2140	1780	0	0	0	0	911	197	0.041	1670	0.183	0.011	799	------	------
OP#1	2158	500	0	0	0	0	250	0.0451	1685	0.1837	0.0111	841	----P--	41.07
OP#2	2253	250	2000	0	164	4	230	0.0464	1670	0.1816	0.011	800	-------	13.97
OP#3	2073	125	0	179	1894	0	228	0.0413	1670	0.17	0.011	797	-------	8.15
2141	1737	0	0	0	0	596	198	0.059	1666	0.243	0.016	355	------	------
OP#1	1225	0	0	0	0	0	250	0.0567	1661	0.2357	0.0138	430	-------	32.98
OP#2	1533	0	1793	0	0	0	238	0.0612	1661	0.2428	0.0158	355	-------	8.77
OP#3	1449	344	0	196	0	0	250	0.059	1662	0.2202	0.0134	355	-------	13.1
2142	1775	0	0	0	0	772	194	0.054	1666	0.201	0.015	830	------	------
OP#1	1567	31	1503	0	0	0	223	0.0506	1666	0.2031	0.0147	830	-------	7.4
OP#2	1958	34	0	0	1092	59	249	0.0515	1666	0.201	0.0124	830	-------	4.63
OP#3	1567	0	0	79	938	0	188	0.049	1666	0.198	0.015	826	-------	11.5
2144	1602	0	0	0	0	920	207	0.055	1660	0.23	0.021	708	------	------
OP#1	1364	0	1875	0	0	0	250	0.0531	1656	0.2246	0.0164	706	-------	9.73
OP#2	1723	0	0	0	1210	0	226	0.0534	1656	0.2188	0.0148	708	-------	11.56
OP#3	1335	60	0	10	103	0	188	0.055	1660	0.217	0.0171	709	-------	5.84
2145	1887	0	0	0	0	109	200	0.057	1668	0.247	0.016	387	------	------
OP#1	1550	0	0	0	0	0	250	0.0555	1663	0.2195	0.0125	453	-------	35.68
OP#2	1647	0	217	0	0	0	218	0.0603	1663	0.2349	0.0159	450	-------	32.36
OP#3	2060	109	0	881	0	0	250	0.0573	1666	0.1882	0.0099	386	-------	26.23
2147	1891	0	0	0	0	546	198	0.049	1656	0.207	0.011	383	------	------
OP#1	1723	0	0	0	0	0	250	0.0522	1658	0.2098	0.0127	519	----P--	203.23
OP#2	2036	0	1503	0	0	1627	247	0.0538	1644	0.179	0.011	540	-T-----	146.12
OP#3	1972	500	0	827	0	0	250	0.0492	1651	0.1621	0.0094	383	-------	26.87
2149	1526	0	0	0	0	0	198	0.06	1666	0.238	0.011	365	------	------
OP#1	1347	0	0	0	0	0	250	0.0534	1661	0.2138	0.0123	495	C---P--	199.37
OP#2	1645	0	678	0	0	2072	250	0.0584	1648	0.1837	0.011	517	-T-----	210.46
OP#3	1916	0	0	1162	0	0	250	0.0589	1661	0.1791	0.0087	364	-------	31.64
2150	1763	0	0	512	0	798	184	0.047	1657	0.167	0.009	762	------	------
OP#1	1909	500	0	0	0	0	250	0.0472	1672	0.1834	0.0116	799	----P--	315.2
OP#2	2192	376	1773	0	20	1345	247	0.0481	1653	0.1519	0.009	762	-------	15.92
OP#3	1950	0	1501	1392	1329	0	172	0.0468	1657	0.1315	0.009	735	-------	25.24
2152	1575	0	0	0	0	0	197	0.05	1669	0.208	0.015	781	------	------
OP#1	1467	172	1425	0	0	0	250	0.05	1669	0.1866	0.0144	781	-------	10.36
OP#2	1716	147	22	0	557	0	207	0.0499	1669	0.1925	0.0148	782	-------	7.72
OP#3	1388	29	0	527	0	0	167	0.05	1669	0.1815	0.0149	793	-------	14.7

2153	1396	0	0	0	0	0	183	0.054	1660	0.161	0.007	480	------	------
OP#1	1503	199	0	0	0	0	250	0.0496	1675	0.1924	0.0106	642	--MnP--	593.54
OP#2	1723	0	1376	0	0	2370	250	0.0556	1655	0.1426	0.007	635	-------	55.09
OP#3	1730	6	0	879	1105	0	245	0.0548	1660	0.1609	0.007	482	-------	2.03
2156	2049	0	0	0	0	1941	181	0.046	1634	0.173	0.011	482	------	------
OP#1	2038	375	0	0	0	0	250	0.0529	1650	0.1955	0.0113	640	CT--P--	153.79
OP#2	2087	66	1994	0	15	1498	194	0.0527	1633	0.1664	0.0109	497	-------	22.46
OP#3	1990	500	0	216	1777	0	243	0.0489	1634	0.1639	0.0109	483	-------	11.72
2157	2642	0	0	0	0	0	219	0.036	1673	0.117	0.009	1111	------	------
OP#1	2625	488	1032	0	0	0	250	0.0369	1673	0.1114	0.0086	1111	-------	7.42
OP#2	2566	0	0	0	0	0	218	0.036	1668	0.1023	0.0076	1140	-------	19.98
OP#3	2469	0	0	0	0	0	246	0.0323	1668	0.1109	0.0089	977	-------	32.36
2159	2184	0	0	0	0	0	195	0.04	1678	0.165	0.011	937	------	------
OP#1	2596	500	129	0	0	0	228	0.0452	1692	0.152	0.0088	936	-------	34.78
OP#2	2434	73	2000	0	315	0	140	0.0404	1678	0.1283	0.0092	937	-------	23.44
OP#3	2058	84	0	4	166	0	195	0.0401	1678	0.157	0.0106	939	-------	5.2
2160	2424	0	0	0	0	475	190	0.042	1670	0.154	0.011	484	------	------
OP#1	2522	207	0	0	0	0	250	0.0496	1685	0.1819	0.0122	646	C---P--	247.18
OP#2	2576	1	2000	0	0	809	218	0.0492	1665	0.1459	0.011	647	-------	71.15
OP#3	2256	500	0	413	0	0	250	0.0463	1665	0.1506	0.0096	484	-------	17.51
2161	1798	0	0	0	0	0	198	0.042	1657	0.127	0.007	503	------	------
OP#1	1880	15	0	0	0	0	250	0.0451	1671	0.1444	0.0082	664	----P--	237.07
OP#2	1718	0	2000	0	0	1157	185	0.0489	1645	0.1193	0.007	666	-T-----	137.12
OP#3	1726	250	0	524	0	0	250	0.0482	1652	0.1251	0.0063	533	-------	26.97
2162	1751	0	0	0	0	0	193	0.045	1651	0.145	0.007	480	------	------
OP#1	1723	11	0	0	0	0	250	0.0462	1658	0.1551	0.0087	641	----P--	297.11
OP#2	1723	0	1546	0	0	1451	229	0.0519	1636	0.1281	0.007	626	-T-----	175.56
OP#3	1882	125	0	885	0	0	250	0.0511	1646	0.1239	0.0064	486	-------	34.27
2169	1146	0	0	0	0	3969	173	0.047	1667	0.174	0.013	748	------	------
OP#1	1388	220	0	0	0	0	237	0.0471	1671	0.1937	0.0128	748	-------	15.61
OP#2	1823	70	1498	0	183	985	247	0.047	1667	0.1738	0.0122	748	-------	0.18
OP#3	1679	0	514	47	2356	0	236	0.0467	1667	0.1739	0.013	750	-------	1.69
2173	2448	0	0	0	0	1012	191	0.042	1617	0.091	0.005	647	------	------
OP#1	2459	344	0	0	0	0	250	0.0439	1635	0.1209	0.0062	809	-T--P--	346.59
OP#2	2324	0	2000	0	0	1216	181	0.042	1614	0.091	0.0045	725	-------	15.55
OP#3	2586	65	4	799	1874	0	249	0.0437	1618	0.089	0.005	648	-------	7.63
2174	1986	0	0	0	0	0	189	0.037	1670	0.128	0.012	1115	------	------
OP#1	2271	330	0	0	0	0	185	0.0407	1677	0.1281	0.0096	1114	-------	17.04
OP#2	2341	125	242	0	794	231	197	0.037	1670	0.1277	0.0094	1114	-------	0.42
OP#3	1887	0	1011	328	469	0	166	0.0367	1670	0.128	0.012	1058	-------	6.15
2175	2055	0	0	0	0	0	210	0.058	1670	0.186	0.011	439	------	------
OP#1	1814	0	0	0	0	0	250	0.0527	1667	0.1995	0.0118	509	----P--	107.03
OP#2	2192	0	1478	0	0	575	250	0.0531	1662	0.1702	0.011	597	-T-----	86.4
OP#3	2131	0	0	723	0	0	250	0.0569	1665	0.1751	0.0097	455	-------	17
2176	2518	0	0	0	0	0	181	0.043	1630	0.105	0.007	945	------	------
OP#1	2429	488	6	0	0	0	239	0.0418	1635	0.1182	0.007	944	-------	20.5
OP#2	2566	17	180	0	586	106	250	0.0413	1630	0.105	0.0052	945	-------	4.1
OP#3	2381	0	0	1221	78	0	191	0.0423	1630	0.0856	0.007	787	-------	38.96
2177	2383	0	0	0	0	0	205	0.044	1680	0.202	0.017	645	------	------
OP#1	2256	78	311	0	0	0	250	0.0491	1680	0.1865	0.0125	643	-------	19.47
OP#2	2351	0	498	0	0	0	195	0.0455	1676	0.183	0.0147	687	-------	23.84
OP#3	2354	250	0	88	78	0	250	0.0449	1680	0.1695	0.0123	645	-------	18.28

2178	2181	0	0	0	0	0	182	0.04	1674	0.098	0.007	1135	------	------
OP#1	2273	500	0	0	0	0	250	0.0346	1681	0.1189	0.0081	1049	----P--	205.41
OP#2	2349	0	61	0	15	1372	250	0.0349	1668	0.0984	0.007	1078	-T-----	39.8
OP#3	2212	12	2000	1126	310	0	195	0.0336	1669	0.0726	0.007	934	-----O-	100.03
2182	2278	0	0	0	0	501	202	0.035	1697	0.134	0.009	1059	------	------
OP#1	2791	500	0	0	0	0	250	0.0377	1712	0.1357	0.0102	987	----P--	164
OP#2	2977	102	1990	0	5	172	250	0.0343	1695	0.1204	0.009	1062	-------	13.91
OP#3	2566	0	0	833	0	0	214	0.0349	1697	0.1299	0.009	906	-------	17.83
2186	2294	0	0	0	0	0	206	0.05	1673	0.168	0.01	477	------	------
OP#1	2349	0	0	0	0	0	250	0.0473	1677	0.1713	0.0101	615	-------	46.56
OP#2	2332	0	1627	0	0	0	246	0.052	1659	0.1645	0.0097	639	-T-----	140.33
OP#3	2346	0	0	301	0	0	250	0.0493	1668	0.1646	0.0099	638	-------	45.15
2194	2420	0	0	543	0	3001	185	0.04	1656	0.12	0.016	1026	------	------
OP#1	2395	500	0	0	0	0	140	0.0488	1673	0.15	0.0125	1186	CT-----	191.24
OP#2	2850	328	436	0	1449	2002	217	0.04	1656	0.1195	0.0074	1027	-------	0.59
OP#3	2273	63	1629	1137	2500	0	141	0.04	1663	0.12	0.0103	937	-------	15.89
2201	1742	0	0	0	993	2002	209	0.043	1650	0.139	0.014	952	------	------
OP#1	1721	16	0	0	0	0	160	0.048	1665	0.1599	0.0123	950	-------	41.78
OP#2	2271	63	1251	0	1882	1482	243	0.043	1650	0.1389	0.0084	949	-------	0.62
OP#3	1413	250	1846	367	2422	0	142	0.0424	1650	0.1389	0.0139	920	-------	4.82
2210	1427	0	0	899	0	0	215	0.051	1670	0.158	0.01	880	------	------
OP#1	1550	500	0	0	0	0	250	0.0469	1685	0.1749	0.0107	805	----P--	114.01
OP#2	1801	16	544	0	1339	997	240	0.0501	1670	0.1588	0.0097	879	-------	2.44
OP#3	1435	0	127	985	1014	0	177	0.0501	1670	0.1538	0.01	719	-------	23.78
2213	1950	0	0	0	0	0	224	0.04	1689	0.171	0.018	1003	------	------
OP#1	2447	457	0	0	0	0	223	0.0413	1697	0.171	0.0139	1003	-------	11.3
OP#2	2608	39	4	0	608	246	250	0.04	1689	0.1717	0.0147	1002	-------	0.57
OP#3	2019	0	495	521	0	0	156	0.04	1688	0.171	0.0165	1003	-------	0.9
2215	1874	0	0	0	0	0	216	0.048	1653	0.127	0.007	825	------	------
OP#1	2178	499	0	0	0	0	250	0.0427	1657	0.1379	0.0094	888	----P--	381.54
OP#2	2420	0	1955	0	0	680	250	0.042	1648	0.1034	0.007	826	-------	35.97
OP#3	2346	0	563	917	332	0	243	0.0443	1653	0.1009	0.007	663	-------	48.22
2217	2243	0	0	330	0	0	221	0.04	1686	0.149	0.012	918	------	------
OP#1	2503	389	0	0	0	0	226	0.0437	1701	0.159	0.0117	920	-------	31.09
OP#2	2503	250	999	0	20	375	189	0.0402	1686	0.1398	0.012	918	-------	6.65
OP#3	2273	0	237	142	1557	0	212	0.04	1686	0.1491	0.0118	912	-------	0.79
2218	2149	0	0	416	0	0	220	0.037	1700	0.119	0.009	1099	------	------
OP#1	2798	500	0	0	0	0	250	0.0368	1715	0.1257	0.0091	1005	-------	36.94
OP#2	2830	96	160	0	37	133	250	0.0365	1700	0.119	0.0087	1099	-------	1.37
OP#3	2337	0	547	744	0	0	192	0.0357	1695	0.1191	0.009	957	-------	21.81
2219	1723	0	0	528	0	0	230	0.041	1689	0.143	0.009	841	------	------
OP#1	2190	500	0	0	0	0	250	0.0428	1704	0.1661	0.0114	887	----P--	307.38
OP#2	2322	0	645	0	0	2002	238	0.0438	1684	0.1197	0.009	890	-------	33.74
OP#3	2195	0	0	701	1249	0	222	0.0407	1689	0.1363	0.0089	805	-------	10.14
2220	1675	0	0	406	0	0	223	0.044	1686	0.156	0.012	918	------	------
OP#1	1840	377	0	0	0	0	223	0.0441	1687	0.1661	0.0119	919	-------	8.17
OP#2	2156	0	407	0	645	121	250	0.044	1686	0.1561	0.0116	917	-------	0.23
OP#3	1723	4	88	747	5	0	176	0.044	1685	0.1471	0.012	854	-------	13.83
2223	2322	0	0	0	0	805	225	0.056	1667	0.173	0.014	566	------	------
OP#1	2012	0	0	0	0	0	243	0.0512	1667	0.1924	0.0114	564	-------	20.07
OP#2	2146	0	373	0	0	20	250	0.0554	1662	0.1829	0.0117	588	-------	15.68
OP#3	2139	3	248	378	0	0	240	0.0543	1665	0.173	0.0109	568	-------	5.61

2229	3582	0	0	0	0	484	222	0.033	1666	0.103	0.008	1276	------	------
OP#1	3600	500	0	0	0	0	193	0.0422	1670	0.1196	0.0086	1115	C---P--	257.85
OP#2	3580	0	0	0	626	43	194	0.0326	1664	0.103	0.008	1162	-------	12.64
OP#3	3331	0	1892	1243	98	0	155	0.03	1662	0.0793	0.008	1083	-----O-	75.62
2285	2223	0	0	1401	0	1165	215	0.045	1627	0.093	0.007	949	------	------
OP#1	2820	500	0	0	0	0	250	0.0398	1668	0.1227	0.0088	946	-T--P--	591.36
OP#2	2740	0	0	0	1056	2565	248	0.0413	1627	0.093	0.0043	937	-------	9.62
OP#3	2593	0	1439	1243	2500	0	197	0.0413	1635	0.0892	0.007	786	-------	38.23
2287	1843	0	0	919	0	728	223	0.037	1661	0.109	0.008	1129	------	------
OP#1	2117	500	0	0	0	0	250	0.0384	1681	0.1388	0.0088	974	-T--P--	210.74
OP#2	2349	0	1001	0	1386	997	248	0.037	1661	0.1097	0.0066	1128	-------	0.77
OP#3	1972	0	1394	1269	1520	0	157	0.0363	1660	0.0842	0.008	968	-------	40.15
2291	1603	0	0	267	0	480	228	0.047	1641	0.115	0.006	859	------	------
OP#1	1726	500	0	0	0	0	250	0.0452	1656	0.1423	0.0061	839	----P--	64.42
OP#2	1611	173	72	0	132	1709	168	0.047	1641	0.115	0.0057	859	-------	0.16
OP#3	1567	37	63	1223	386	0	173	0.0471	1641	0.1139	0.006	736	-------	15.48
2301	1710	0	0	0	0	518	219	0.05	1660	0.172	0.011	718	------	------
OP#1	1836	375	256	0	0	0	250	0.0504	1660	0.169	0.0103	718	-------	2.64
OP#2	2195	280	248	0	88	0	245	0.0502	1660	0.1704	0.0103	718	-------	1.31
OP#3	1875	15	0	821	442	0	184	0.05	1660	0.1569	0.011	718	-------	8.85
2307	1575	0	0	0	0	0	220	0.042	1688	0.16	0.016	1029	------	------
OP#1	1997	360	0	0	0	0	196	0.0434	1699	0.1601	0.0126	1029	-------	14.89
OP#2	2337	0	743	0	1251	958	250	0.042	1687	0.16	0.0117	1029	-------	1.13
OP#3	1608	0	1891	703	586	0	140	0.0417	1688	0.16	0.0143	989	-------	4.54
2329	2335	0	0	864	0	0	229	0.037	1699	0.119	0.013	859	------	------
OP#1	2691	0	0	0	0	0	226	0.0396	1714	0.1357	0.013	860	-------	36.03
OP#2	2901	0	1593	0	0	610	250	0.036	1694	0.1207	0.0118	943	-------	18.79
OP#3	2622	0	1439	651	626	0	228	0.0371	1699	0.119	0.0106	857	-------	0.49
2333	1399	249	0	890	1991	0	186	0.042	1628	0.103	0.007	687	------	------
OP#1	1459	500	0	0	0	0	250	0.0453	1643	0.132	0.0073	836	----P--	114.62
OP#2	1569	400	2000	0	0	1146	165	0.0424	1628	0.1029	0.0065	727	-------	6.9
OP#3	1581	204	0	506	2500	0	223	0.0443	1632	0.0922	0.007	687	-------	20.16
2339	1910	0	0	0	0	0	206	0.044	1682	0.138	0.01	830	------	------
OP#1	2019	297	0	0	0	0	225	0.0467	1692	0.138	0.0099	831	-------	.16
OP#2	2219	296	1664	0	7	0	202	0.0443	1682	0.1329	0.01	830	-------	4.44
OP#3	1838	26	352	435	924	0	198	0.0441	1682	0.1381	0.01	830	-------	0.38
2341	1307	0	0	0	0	0	203	0.045	1668	0.162	0.013	684	------	------
OP#1	1369	0	0	0	0	0	222	0.0491	1679	0.1626	0.0114	686	-------	20.39
OP#2	1589	469	2000	0	0	133	163	0.0453	1668	0.1619	0.0127	682	-------	1.4
OP#3	1120	469	0	19	978	0	202	0.0453	1668	0.1525	0.0124	683	-------	6.55
2343	1872	0	0	0	0	0	199	0.045	1682	0.162	0.01	664	------	------
OP#1	2183	149	0	0	0	0	250	0.0476	1686	0.162	0.0098	664	-------	10.26
OP#2	2332	0	999	0	0	282	249	0.0506	1677	0.1489	0.01	782	-------	43.05
OP#3	2239	105	0	350	0	0	250	0.045	1679	0.1498	0.009	666	-------	10.64
2351	1950	0	0	0	0	1019	203	0.044	1671	0.181	0.013	538	------	------
OP#1	2031	125	0	0	0	0	250	0.0495	1686	0.1832	0.0126	617	-------	48.99
OP#2	2207	0	2000	0	0	540	236	0.0509	1670	0.1803	0.013	552	-------	19.37
OP#3	1755	500	0	88	352	0	236	0.0478	1671	0.1801	0.0129	535	-------	9.77
2357	1607	0	0	0	0	0	206	0.049	1675	0.18	0.012	578	------	------
OP#1	1515	10	2	0	0	0	250	0.0495	1682	0.1802	0.0105	577	-------	8.67
OP#2	1726	0	2000	0	0	0	232	0.0529	1675	0.1777	0.0113	578	-------	9.69
OP#3	1491	250	0	19	396	0	243	0.0503	1675	0.1728	0.0108	579	-------	6.93

2362	2329	0	0	0	0	0	208	0.036	1668	0.096	0.006	675	------	------
OP#1	2351	0	0	0	0	0	250	0.0375	1663	0.094	0.0058	811	-------	31.12
OP#2	2097	0	1064	0	0	0	212	0.0409	1642	0.0922	0.006	837	-T-----	276.48
OP#3	2781	0	0	1073	0	0	250	0.0321	1663	0.0376	0.0029	834	-------	100.64
2365	3000	0	0	0	0	0	196	0.03	1662	0.063	0.005	1061	------	------
OP#1	2710	0	936	0	0	0	250	0.03	1644	0.0468	0.0028	1061	-T-----	169.83
OP#2	2508	0	2	0	0	0	236	0.0318	1629	0.0305	-0.0006	1223	-T-----	384.87
OP#3	2349	1	0	0	0	0	247	0.0301	1627	0.0422	0.0047	1013	-T-----	368.81
2369	2096	0	0	0	0	0	205	0.039	1654	0.166	0.012	613	------	------
OP#1	2231	0	0	0	0	0	250	0.0443	1656	0.1501	0.0087	675	-------	35.22
OP#2	2112	0	33	0	0	0	206	0.0459	1648	0.1477	0.0104	775	-T-----	74.85
OP#3	2195	375	0	44	0	0	250	0.0391	1650	0.1193	0.0096	703	-------	47.14
2375	1691	0	0	0	0	703	200	0.045	1654	0.19	0.013	439	------	------
OP#1	1481	0	0	0	0	0	250	0.0503	1657	0.1893	0.0108	556	-------	41.55
OP#2	1540	0	2000	0	0	63	191	0.0519	1650	0.1852	0.013	502	-------	36.3
OP#3	1689	500	0	513	0	0	250	0.0482	1653	0.1409	0.0089	439	-------	34.21
2381	2604	0	0	0	0	0	204	0.034	1706	0.135	0.011	859	------	------
OP#1	2935	30	45	0	0	0	250	0.0358	1706	0.1255	0.0104	859	-------	12.44
OP#2	2960	0	1157	0	0	0	250	0.0335	1686	0.1252	0.0109	1021	-T-----	197.23
OP#3	3087	0	0	701	0	0	250	0.0301	1698	0.1049	0.0089	916	-T-----	77.94
2385	2047	0	0	0	0	0	199	0.043	1681	0.174	0.011	492	------	------
OP#1	2095	0	0	0	0	0	250	0.0456	1687	0.1735	0.0115	650	----P--	94.37
OP#2	2168	0	1654	0	0	751	241	0.0485	1666	0.1632	0.011	655	-T-----	164.06
OP#3	2312	250	0	1050	0	0	250	0.0445	1676	0.1329	0.0073	530	-------	39.56
2387	2020	0	0	0	0	217	194	0.054	1669	0.177	0.011	430	------	------
OP#1	1902	0	0	0	0	0	250	0.0511	1669	0.1906	0.0119	541	----P--	124.38
OP#2	2305	0	1908	0	0	324	250	0.0499	1663	0.17	0.011	592	-------	64.16
OP#3	2087	57	0	697	0	0	250	0.0567	1664	0.1769	0.0101	439	-------	12.32
2392	2069	0	0	0	0	1521	188	0.039	1643	0.12	0.008	620	------	------
OP#1	2307	250	0	0	0	0	250	0.0442	1658	0.1447	0.0085	768	----P--	135.54
OP#2	2378	0	2000	0	0	966	209	0.0421	1642	0.1201	0.0073	782	-------	35.57
OP#3	2112	482	0	541	0	0	236	0.0398	1643	0.1185	0.008	621	-------	3.52
2394	1870	0	0	0	0	1649	187	0.043	1636	0.13	0.008	555	------	------
OP#1	1870	336	0	0	0	0	250	0.0484	1654	0.1601	0.0092	717	-T--P--	264.05
OP#2	1882	0	2000	0	0	2002	181	0.0475	1632	0.1267	0.008	555	-------	16.96
OP#3	1889	429	18	706	1994	0	226	0.045	1636	0.1174	0.0076	556	-------	14.58
2399	1992	0	0	0	0	646	201	0.052	1682	0.207	0.013	646	------	------
OP#1	1999	148	0	0	0	0	250	0.0485	1682	0.2026	0.013	646	-------	8.94
OP#2	2332	0	749	0	0	751	250	0.0478	1677	0.1828	0.013	743	-------	39.74
OP#3	2043	0	626	508	0	0	222	0.0513	1677	0.1911	0.013	648	-------	14.34
2400	1621	0	0	473	0	0	199	0.045	1682	0.192	0.013	683	------	------
OP#1	1738	22	123	0	0	0	250	0.045	1677	0.1908	0.0128	683	-------	5.37
OP#2	2107	0	358	0	0	500	250	0.0439	1677	0.1749	0.013	839	-------	38.96
OP#3	1904	125	0	88	0	0	250	0.0451	1678	0.1762	0.0129	691	-------	13.21
2405	1451	488	0	591	0	0	194	0.039	1705	0.142	0.008	762	------	------
OP#1	2036	500	0	0	0	0	250	0.0413	1722	0.1723	0.0119	915	-T--P--	575.15
OP#2	2251	0	1869	0	0	2776	250	0.043	1693	0.1138	0.008	924	-T-----	133.75
OP#3	2034	82	174	920	508	0	227	0.039	1705	0.142	0.0079	761	-------	0.26
2409	2154	0	0	0	0	0	200	0.043	1658	0.144	0.006	528	------	------
OP#1	2349	11	0	0	0	0	250	0.0438	1667	0.1376	0.0066	689	----P--	143.13
OP#2	2007	0	1021	0	0	500	192	0.049	1641	0.1276	0.006	690	-T-----	189.34
OP#3	2224	125	0	365	0	0	250	0.0443	1653	0.1194	0.0059	668	-------	51.58

2422	1490	0	0	0	0	1799	192	0.049	1678	0.17	0.011	424	------	------
OP#1	1335	250	0	0	0	0	250	0.0543	1696	0.2133	0.0126	568	-TMnP--	335.91
OP#2	1530	0	2000	0	0	2502	192	0.0559	1673	0.1625	0.011	425	-------	23.63
OP#3	1234	499	16	714	936	0	209	0.0536	1678	0.17	0.0094	424	-------	9.58
2430	1917	0	0	899	0	0	189	0.053	1687	0.163	0.011	530	------	------
OP#1	1958	1	0	0	0	0	250	0.0505	1701	0.193	0.0124	552	----P--	169.51
OP#2	2075	0	2000	0	0	184	236	0.0547	1683	0.1632	0.0109	539	-------	8.62
OP#3	1884	125	516	268	511	0	249	0.0532	1687	0.1629	0.0091	532	-------	0.75
2432	2097	0	0	896	0	29	183	0.05	1649	0.153	0.007	466	------	------
OP#1	2192	140	0	0	0	0	250	0.0496	1662	0.1734	0.0095	621	----P--	413.47
OP#2	2332	0	2000	0	0	837	250	0.0525	1644	0.1371	0.007	591	-------	46.87
OP#3	2275	106	0	883	134	0	246	0.0535	1649	0.1397	0.0069	463	-------	16.41
2442	1898	0	0	902	0	0	203	0.058	1678	0.168	0.009	418	------	------
OP#1	1723	0	0	0	0	0	250	0.0527	1682	0.1843	0.0102	508	----P--	182.86
OP#2	2009	4	1732	0	0	289	250	0.0567	1673	0.1585	0.009	574	-------	50.34
OP#3	1809	23	340	502	0	0	250	0.058	1673	0.168	0.008	456	-------	14.21
2446	2054	0	0	0	0	0	205	0.051	1685	0.15	0.008	491	------	------
OP#1	1955	0	0	0	0	0	250	0.0457	1685	0.151	0.0083	647	----P--	78.67
OP#2	1875	16	1816	0	10	270	244	0.0541	1663	0.1506	0.008	646	-T-----	231.3
OP#3	2222	0	0	810	0	0	249	0.0447	1678	0.1237	0.0056	655	-T-----	89.91
2448	1950	0	0	0	0	456	205	0.054	1659	0.184	0.009	444	------	------
OP#1	1826	0	0	0	0	0	250	0.0512	1664	0.184	0.0097	538	----P--	113.92
OP#2	2012	0	1500	0	0	375	250	0.0556	1654	0.1689	0.009	554	-------	41.28
OP#3	1848	169	0	432	0	0	250	0.0559	1654	0.1699	0.0089	444	-------	16.19
2452	1957	0	0	0	0	0	215	0.042	1677	0.164	0.008	540	------	------
OP#1	2153	3	0	0	0	0	250	0.043	1683	0.1509	0.0088	701	----P--	147.41
OP#2	2034	0	1869	0	0	817	233	0.0488	1656	0.1398	0.008	702	-T-----	237.02
OP#3	2293	109	0	751	0	0	250	0.0421	1672	0.1218	0.0065	662	-------	53.61
2456	1768	0	0	0	0	4	208	0.055	1653	0.195	0.009	436	------	------
OP#1	1584	0	0	0	0	0	250	0.0504	1653	0.1778	0.0094	555	----P--	94.36
OP#2	1723	0	362	0	0	1067	250	0.0568	1643	0.1652	0.009	570	-T-----	109.94
OP#3	1843	125	0	742	0	0	250	0.0551	1648	0.1524	0.008	436	-------	26.95
2458	2059	0	0	0	0	99	209	0.046	1671	0.167	0.009	576	------	------
OP#1	2285	250	0	0	0	0	250	0.046	1679	0.1647	0.0096	732	----P--	100.08
OP#2	2339	0	354	0	0	1001	248	0.0493	1664	0.151	0.0089	738	-T-----	73.88
OP#3	2195	250	0	437	0	0	250	0.0463	1667	0.1515	0.0088	577	-------	14.07
2460	2113	0	0	0	1387	2899	195	0.048	1619	0.151	0.009	550	------	------
OP#1	2034	500	0	0	0	0	250	0.052	1654	0.1927	0.0102	705	-TMnP--	517.62
OP#2	1960	480	1984	0	357	2307	144	0.0484	1619	0.151	0.0086	550	-------	0.99
OP#3	1926	457	0	832	2500	0	197	0.0481	1631	0.1407	0.009	549	-------	19.14
2466	1931	0	0	0	0	525	211	0.048	1668	0.139	0.01	713	------	------
OP#1	2251	321	0	0	0	0	250	0.0431	1681	0.1575	0.01	816	-------	50.56
OP#2	2241	0	1955	0	0	246	250	0.0475	1663	0.1519	0.0097	713	-------	15.29
OP#3	2019	15	999	850	0	0	202	0.0476	1664	0.1391	0.0098	711	-------	4.72
2468	1612	0	0	482	0	523	214	0.048	1660	0.158	0.009	661	------	------
OP#1	1718	492	0	0	0	0	250	0.0459	1675	0.1713	0.01	823	----P--	166.89
OP#2	1877	219	2000	0	0	782	248	0.0501	1659	0.157	0.009	661	-------	6.88
OP#3	1577	188	145	1185	506	0	177	0.0479	1660	0.1355	0.009	660	-------	14.75
2472	2049	0	0	707	0	2493	199	0.043	1614	0.107	0.007	641	------	------
OP#1	2349	313	0	0	0	0	250	0.0436	1662	0.1371	0.0089	803	-T--P--	704.59
OP#2	2038	422	2000	0	32	2456	154	0.043	1614	0.107	0.0064	641	-------	0.14
OP#3	1931	439	4	1251	2500	0	182	0.0431	1621	0.0943	0.007	624	-------	21.65

2484	1406	0	0	911	2527	0	206	0.044	1666	0.174	0.009	628	------	------
OP#1	1432	500	0	0	0	0	250	0.0486	1681	0.1807	0.0109	772	----P--	259.62
OP#2	1752	10	1935	0	93	2002	240	0.0509	1666	0.1442	0.009	627	-------	32.91
OP#3	1530	383	516	311	2500	0	233	0.0439	1667	0.139	0.009	625	-------	22.55
2488	1441	0	0	0	0	0	208	0.055	1681	0.228	0.015	404	------	------
OP#1	1205	0	0	0	0	0	250	0.0519	1676	0.2121	0.0125	525	-------	47.55
OP#2	1379	0	436	0	0	0	242	0.0591	1676	0.2175	0.015	520	-------	45.67
OP#3	1682	160	0	896	0	0	250	0.055	1676	0.1654	0.0087	405	-------	32.47
2490	2800	0	0	0	0	0	209	0.039	1702	0.159	0.01	765	------	------
OP#1	2935	414	0	0	0	0	250	0.0392	1704	0.1483	0.0121	926	----P--	240.32
OP#2	2974	0	1376	0	0	1130	249	0.0377	1678	0.1147	0.01	927	-T-----	262.73
OP#3	2974	0	0	591	0	0	250	0.0348	1697	0.1259	0.01	849	-------	48.58
2492	2337	0	0	0	0	0	206	0.044	1666	0.143	0.009	620	------	------
OP#1	2447	379	0	0	0	0	250	0.0459	1681	0.1634	0.0103	782	----P--	205.49
OP#2	2513	0	2000	0	0	536	248	0.0479	1662	0.143	0.009	668	-------	20.16
OP#3	2224	321	0	701	0	0	222	0.0441	1666	0.1356	0.009	623	-------	6.3
2499	2961	0	0	0	0	0	230	0.04	1682	0.103	0.006	1160	------	------
OP#1	3082	500	0	0	0	0	250	0.0347	1686	0.1049	0.0074	1047	----P--	255.51
OP#2	3065	1	370	0	39	246	250	0.033	1671	0.088	0.006	1149	-T-----	100.82
OP#3	2974	0	1939	701	0	0	230	0.0283	1676	0.0667	0.006	996	C------	137.59
2514	2145	0	0	0	0	1187	205	0.05	1669	0.2	0.02	709	------	------
OP#1	1816	126	0	0	0	0	211	0.0524	1670	0.2006	0.0145	709	-------	6.6
OP#2	2278	250	395	0	447	375	248	0.0501	1669	0.2	0.0149	708	-------	0.31
OP#3	1767	194	133	96	1014	0	197	0.0499	1669	0.1999	0.0166	711	-------	0.55
2516	1953	0	0	0	0	1405	206	0.046	1659	0.152	0.01	796	------	------
OP#1	2114	500	0	0	0	0	250	0.0466	1674	0.1658	0.0107	811	----P--	95.3
OP#2	2310	156	1500	0	186	1064	235	0.0466	1659	0.1464	0.01	796	-------	5.08
OP#3	2214	0	0	714	2036	0	219	0.0452	1659	0.1469	0.01	734	-------	13.14
2518	2309	0	0	0	1781	3021	194	0.047	1637	0.135	0.009	758	------	------
OP#1	2877	500	0	0	0	0	250	0.0438	1696	0.165	0.0119	866	-T--P--	855.78
OP#2	2613	8	1636	0	1439	2940	220	0.047	1637	0.1348	0.0083	758	-------	0.28
OP#3	2515	118	1124	1356	2500	0	195	0.047	1652	0.135	0.0089	635	-------	31.27
2520	2038	0	0	0	0	1297	208	0.048	1660	0.132	0.009	791	------	------
OP#1	2173	486	0	0	0	0	250	0.0427	1670	0.1462	0.009	883	-------	43.13
OP#2	2229	0	1185	0	0	1044	250	0.0462	1655	0.1338	0.0083	802	-------	11.62
OP#3	2163	0	274	835	352	0	218	0.0442	1660	0.132	0.009	737	-------	14.91
2522	1651	0	0	1010	1087	0	211	0.05	1646	0.115	0.006	568	------	------
OP#1	2007	230	0	0	0	0	250	0.0458	1661	0.1401	0.0067	729	----P--	195.21
OP#2	1999	0	2000	0	0	630	226	0.0502	1643	0.115	0.0047	684	-------	23.29
OP#3	2019	32	203	736	626	0	247	0.0501	1645	0.1151	0.0047	565	-------	1.31
2527	2075	0	0	0	0	141	195	0.045	1645	0.142	0.009	796	------	------
OP#1	2285	147	856	0	0	0	250	0.0457	1645	0.1365	0.0085	795	-------	5.53
OP#2	2253	0	0	0	149	0	195	0.0444	1640	0.1327	0.0082	796	-------	12.76
OP#3	2322	0	47	431	39	0	222	0.0444	1645	0.1233	0.009	775	-------	18.56
2530	1653	0	0	812	0	0	211	0.053	1661	0.141	0.009	519	------	------
OP#1	1647	250	0	0	0	0	250	0.0486	1676	0.1837	0.0107	681	--MnP--	371.79
OP#2	1877	0	1793	0	0	2010	250	0.0527	1656	0.1437	0.0079	600	-------	22.98
OP#3	1757	78	751	1293	623	0	209	0.0531	1661	0.141	0.0073	519	-------	0.43
2534	2647	501	0	0	0	0	203	0.035	1699	0.128	0.012	1290	------	------
OP#1	2952	500	0	0	0	0	233	0.0339	1714	0.1345	0.012	1128	-------	37.31
OP#2	2974	0	0	0	401	747	241	0.03	1694	0.1344	0.0119	1128	-------	36.49
OP#3	2557	0	1908	865	1095	0	168	0.0301	1694	0.1125	0.012	1098	-----O-	69.6

2536	2149	0	0	313	2443	0	189	0.046	1629	0.13	0.006	840	------	------
OP#1	2239	500	0	0	0	0	250	0.0476	1644	0.156	0.0081	791	----P--	398.92
OP#2	2451	67	1517	0	1100	626	231	0.046	1629	0.1296	0.0059	840	-------	0.34
OP#3	2449	0	500	1184	2287	0	210	0.0459	1629	0.1051	0.006	683	-------	39.83
2545	2385	0	0	421	0	144	200	0.052	1649	0.154	0.008	687	------	------
OP#1	2271	500	0	0	0	0	250	0.0494	1664	0.1619	0.0081	756	----P--	51.82
OP#2	2229	218	1374	0	64	238	223	0.0534	1649	0.1541	0.0079	687	-------	2.94
OP#3	2122	0	0	898	567	0	202	0.051	1649	0.1482	0.008	652	-------	10.72

Table A5.2 Optimization results for dataset D2

Heat#	O22	LIM2	DOLO2	ORE2	RSL2	RDOLO2	HL2	C2	T2	Mn2	P2	Oact2	Violations	Cost
2551	1870	0	0	865	2510	4	187	0.048	1633	0.156	0.009	589	------	------
AIM	0	0	0	0	0	0	0	0.048	1633	0.13	0.014	589	------	------
OP#1	1882	10	0	0	0	0	192	0.0512	1649	0.1793	0.0123	750	--Mn---	240.87
OP#2	2178	0	1609	0	0	2475	236	0.0474	1628	0.1317	0.0075	590	-------	7.66
OP#3	2007	250	1918	824	1657	0	206	0.0474	1633	0.1301	0.0088	586	-------	1.82
2553	1451	0	0	0	0	0	191	0.047	1695	0.164	0.015	756	------	------
AIM	0	0	0	0	0	0	0	0.047	1695	0.41	0.096	756	------	------
OP#1	1410	14	498	0	0	0	247	0.0465	1694	0.1671	0.0133	757	-------	61.66
OP#2	1413	0	61	0	0	0	140	0.0484	1694	0.1936	0.0184	757	-------	56.79
OP#3	1393	52	0	23	152	0	223	0.047	1695	0.195	0.0147	757	-------	52.71
2555	1836	0	0	0	0	0	195	0.043	1679	0.18	0.012	686	------	------
AIM	0	0	0	0	0	0	0	0.043	1679	0.21	0.014	686	------	------
OP#1	1958	0	0	0	0	0	250	0.0442	1679	0.1718	0.0119	738	-------	28.75
OP#2	1960	1	37	0	0	0	195	0.0446	1674	0.1695	0.0139	801	-------	44.75
OP#3	2038	218	0	110	469	0	250	0.0432	1679	0.1475	0.0104	687	-------	30.4
2561	1813	0	0	807	0	427	192	0.05	1661	0.153	0.01	564	------	------
AIM	0	0	0	0	0	0	0	0.05	1661	0.21	0.014	564	------	------
OP#1	1528	183	6	0	0	0	250	0.0552	1661	0.1927	0.0107	564	-------	18.76
OP#2	1630	0	127	0	626	0	147	0.0542	1661	0.1941	0.0138	564	-------	16.04
OP#3	1432	236	0	12	171	0	217	0.0534	1661	0.1936	0.0118	566	-------	14.94
2563	1811	0	0	600	0	0	192	0.053	1662	0.174	0.009	445	------	------
AIM	0	0	0	0	0	0	0	0.053	1662	0.2	0.016	445	------	------
OP#1	1379	0	0	0	0	0	250	0.0564	1662	0.2035	0.0126	471	-------	14.09
OP#2	1662	30	362	0	225	313	172	0.0536	1662	0.1999	0.0142	445	-------	1.12
OP#3	1413	348	0	138	506	0	232	0.0544	1662	0.1964	0.0119	446	-------	4.73
2571	1741	0	0	758	0	0	189	0.045	1691	0.173	0.013	570	------	------
AIM	0	0	0	0	0	0	0	0.045	1691	1.46	0.012	570	------	------
OP#1	1418	16	0	0	0	0	250	0.0503	1702	0.208	0.0141	612	----P--	288.37
OP#2	1726	0	2000	0	0	1251	250	0.0505	1687	0.1752	0.012	621	-------	113.44
OP#3	1870	234	0	765	2307	0	241	0.0449	1691	0.1537	0.0089	572	-------	90.02
2573	1967	0	0	1006	0	0	190	0.044	1687	0.144	0.01	560	------	------
AIM	0	0	0	0	0	0	0	0.044	1687	1.46	0.012	560	------	------
OP#1	1471	0	0	0	0	0	250	0.0493	1689	0.1893	0.0127	627	----P--	173.49
OP#2	1804	0	2000	0	0	254	250	0.0484	1683	0.1685	0.012	646	-------	117.8
OP#3	2029	216	33	1139	626	0	234	0.0439	1686	0.1256	0.0076	563	-------	92.68
2581	2659	0	0	0	0	0	190	0.036	1698	0.15	0.012	941	------	------
AIM	0	0	0	0	0	0	0	0.036	1698	0.39	0.076	941	------	------
OP#1	2537	374	0	0	0	0	249	0.0413	1701	0.1468	0.011	941	-------	79.92
OP#2	2662	0	751	0	0	0	140	0.0363	1698	0.1412	0.0149	1007	-------	72.1
OP#3	2586	44	0	406	1012	0	214	0.036	1698	0.1397	0.011	942	-------	64.43
2583	3041	0	0	0	0	317	189	0.038	1711	0.168	0.015	906	------	------
AIM	0	0	0	0	0	0	0	0.038	1711	0.39	0.076	906	------	------
OP#1	2943	124	694	0	0	0	248	0.0424	1711	0.1611	0.0135	904	-------	70.47
OP#2	3172	0	8	0	0	0	250	0.036	1706	0.1474	0.013	1018	-------	84.81
OP#3	3092	9	0	0	1877	0	245	0.038	1711	0.1596	0.0121	907	-------	59.27
2585	1921	0	0	0	0	0	191	0.035	1695	0.206	0.015	685	------	------
AIM	0	0	0	0	0	0	0	0.035	1695	0.39	0.076	685	------	------

OP#1	2234	0	0	0	0	0	250	0.0403	1708	0.1599	0.0114	824	-------	107.81
OP#2	2082	0	1875	0	0	0	158	0.0419	1688	0.1592	0.0139	847	-T-----	135
OP#3	2192	500	0	402	709	0	249	0.035	1695	0.1181	0.0077	686	-------	69.99
2587	2187	0	0	0	0	0	183	0.046	1684	0.181	0.015	612	------	------
AIM	0	0	0	0	0	0	0	0.046	1684	0.39	0.076	612	------	------
OP#1	2036	0	0	0	0	0	250	0.048	1683	0.1806	0.0121	654	-------	66.45
OP#2	2195	0	248	0	0	0	250	0.0468	1679	0.1843	0.0126	711	-------	75.81
OP#3	2038	297	0	55	76	0	247	0.046	1684	0.1803	0.0117	612	-------	53.85
2603	2491	0	0	0	0	0	181	0.045	1683	0.146	0.008	472	------	------
AIM	0	0	0	0	0	0	0	0.045	1683	0.2	0.016	472	------	------
OP#1	2016	0	0	0	0	0	250	0.049	1673	0.1792	0.0115	634	-T-----	111.71
OP#2	1877	0	0	0	0	0	170	0.0506	1665	0.1826	0.0138	634	-T-----	202.57
OP#3	2178	250	0	182	0	0	250	0.0454	1678	0.1522	0.0099	620	-------	61.05
2605	2264	0	0	0	779	0	182	0.05	1688	0.186	0.011	458	------	------
AIM	0	0	0	0	0	0	0	0.05	1688	0.2	0.016	458	------	------
OP#1	1928	0	0	0	0	0	250	0.05	1683	0.1975	0.0126	612	-------	39.74
OP#2	1818	0	2	0	0	0	192	0.0522	1676	0.2028	0.0146	619	-T-----	125.21
OP#3	1921	204	0	41	0	0	250	0.05	1683	0.1887	0.0116	569	-------	34.89
2625	1797	0	0	4	0	0	179	0.047	1700	0.205	0.016	570	------	------
AIM	0	0	0	0	0	0	0	0.047	1700	0.21	0.011	570	------	------
OP#1	1711	125	0	0	0	0	250	0.0471	1703	0.2128	0.016	721	----P--	485.41
OP#2	2036	0	1672	0	0	3730	250	0.0444	1668	0.1413	0.011	721	-T-----	369.64
OP#3	2271	31	751	1109	907	0	243	0.0467	1700	0.1645	0.011	572	-------	23.65
2629	1821	0	0	880	2039	0	179	0.048	1665	0.158	0.01	459	------	------
AIM	0	0	0	0	0	0	0	0.048	1665	0.31	0.013	459	------	------
OP#1	1437	0	0	0	0	0	250	0.0533	1675	0.1975	0.0121	539	-------	75.03
OP#2	1572	134	1630	0	39	0	203	0.0544	1665	0.1846	0.0119	459	-------	53.78
OP#3	1305	500	0	36	975	0	238	0.0504	1665	0.1644	0.0098	459	-------	52.1
2633	1982	0	0	779	0	0	183	0.042	1675	0.149	0.008	517	------	------
AIM	0	0	0	0	0	0	0	0.042	1675	0.31	0.013	517	------	------
OP#1	1899	0	2	0	0	0	250	0.0473	1680	0.1837	0.0114	670	-------	88.64
OP#2	1838	0	1011	0	0	0	172	0.0488	1670	0.1724	0.0128	674	-------	95.94
OP#3	2009	500	4	567	0	0	250	0.0423	1674	0.1208	0.0067	517	-------	62.56
2639	2150	0	0	460	0	123	189	0.041	1673	0.118	0.006	546	------	------
AIM	0	0	0	0	0	0	0	0.041	1673	0.61	0.019	546	------	------
OP#1	1892	0	0	0	0	0	250	0.0456	1665	0.1624	0.0094	708	-T-----	151.54
OP#2	1723	0	1251	0	0	0	140	0.0483	1652	0.1565	0.0116	707	-T-----	307.16
OP#3	2349	149	0	798	0	0	250	0.041	1668	0.1022	0.0054	662	-------	109.5
2640	2640	0	0	735	0	0	147	0.049	1654	0.168	0.009	491	------	------
AIM	0	0	0	0	0	0	0	0.049	1654	0.81	0.019	491	------	------
OP#1	2090	0	0	0	0	0	250	0.0537	1654	0.1913	0.0108	530	-------	94.31
OP#2	2043	0	121	0	0	0	154	0.0522	1649	0.1884	0.013	522	-------	94.43
OP#3	2114	437	8	29	313	0	248	0.049	1654	0.1664	0.0096	493	-------	79.96
2642	2343	0	0	0	0	0	148	0.037	1676	0.159	0.015	625	------	------
AIM	0	0	0	0	0	0	0	0.037	1676	0.81	0.019	625	------	------
OP#1	2349	0	0	0	0	0	250	0.0432	1686	0.1605	0.0126	759	C------	154.26
OP#2	2207	0	936	0	0	0	151	0.0429	1671	0.1618	0.0155	787	-------	126.71
OP#3	2896	250	0	1263	1261	0	250	0.0373	1676	0.0892	0.0065	624	-------	89.96
2645	2593	0	0	0	0	536	136	0.044	1618	0.101	0.005	609	------	------
AIM	0	0	0	0	0	0	0	0.044	1618	0.13	0.014	609	------	------
OP#1	2224	0	0	0	0	0	250	0.0476	1613	0.1269	0.0058	663	-------	24.52
OP#2	2273	0	14	0	0	0	164	0.0445	1613	0.102	0.0066	751	-------	51.11

OP#3	2351	2	0	101	0	0	250	0.049	1618	0.1081	0.0063	668	-------	37.95
2657	1968	0	0	997	0	1000	140	0.035	1633	0.075	0.005	735	-------	-------
AIM	0	0	0	0	0	0	0	0.035	1633	0.13	0.014	735	-------	-------
OP#1	2036	31	0	0	0	0	250	0.0404	1648	0.117	0.0069	832	-------	57.69
OP#2	1960	31	2000	0	34	0	167	0.0419	1633	0.1075	0.0082	861	-------	54.05
OP#3	1726	312	0	26	389	0	236	0.0409	1633	0.1073	0.0075	734	-------	34.43
2665	1643	0	0	0	0	0	161	0.041	1677	0.161	0.011	675	-------	-------
AIM	0	0	0	0	0	0	0	0.041	1677	0.14	0.013	675	-------	-------
OP#1	1674	0	0	0	0	0	250	0.0463	1686	0.161	0.0097	692	-------	39.83
OP#2	1836	0	2000	0	0	434	144	0.0456	1677	0.14	0.0118	805	-------	30.52
OP#3	1726	301	0	90	1503	0	248	0.0423	1677	0.1398	0.008	676	-------	3.43
2669	1896	0	0	0	0	761	150	0.039	1682	0.158	0.011	655	-------	-------
AIM	0	0	0	0	0	0	0	0.039	1682	0.14	0.013	655	-------	-------
OP#1	1897	250	0	0	0	0	240	0.0461	1697	0.1647	0.0105	816	C------	121.27
OP#2	1999	47	2000	0	0	809	160	0.0459	1682	0.14	0.0113	791	-------	38.53
OP#3	1765	418	0	197	1557	0	237	0.0411	1682	0.1398	0.0082	657	-------	5.93
2673	2194	0	0	204	0	0	148	0.047	1677	0.207	0.014	445	-------	-------
AIM	0	0	0	0	0	0	0	0.047	1677	0.26	0.013	445	-------	-------
OP#1	1980	0	0	0	0	0	250	0.0523	1679	0.1906	0.0113	562	-------	66.33
OP#2	1980	0	248	0	0	0	241	0.0539	1672	0.195	0.0115	553	-------	68.94
OP#3	1889	500	0	166	0	0	250	0.0488	1673	0.1731	0.0094	445	-------	41.25
2679	2011	0	0	0	0	386	149	0.046	1666	0.172	0.012	456	-------	-------
AIM	0	0	0	0	0	0	0	0.046	1666	0.26	0.013	456	-------	-------
OP#1	1774	0	0	0	0	0	250	0.0513	1663	0.1824	0.0106	584	-------	72.63
OP#2	1723	0	0	0	0	0	168	0.0525	1660	0.1799	0.0129	598	-T-----	92.58
OP#3	1892	499	0	349	0	0	250	0.0462	1661	0.1358	0.0077	471	-------	56.55
2683	1847	0	0	612	0	0	153	0.052	1671	0.217	0.014	413	-------	-------
AIM	0	0	0	0	0	0	0	0.052	1671	0.26	0.016	413	-------	-------
OP#1	1393	0	0	0	0	0	250	0.055	1666	0.2213	0.0134	502	-------	47.02
OP#2	1432	0	45	0	0	0	250	0.0581	1666	0.2279	0.0138	445	-------	36.94
OP#3	1728	339	0	450	0	0	250	0.052	1671	0.1821	0.0104	413	-------	30.19
2684	2201	0	0	0	0	0	153	0.052	1672	0.156	0.01	485	-------	-------
AIM	0	0	0	0	0	0	0	0.052	1672	0.41	0.016	485	-------	-------
OP#1	1816	0	0	0	0	0	250	0.0545	1667	0.1816	0.0098	512	-------	71.12
OP#2	1982	0	4	0	0	0	244	0.0545	1667	0.1738	0.0093	525	-------	75.79
OP#3	2043	195	0	389	0	0	250	0.052	1671	0.1584	0.0076	484	-------	62.57
2689	2393	0	0	0	0	2276	142	0.034	1626	0.1	0.007	649	-------	-------
AIM	0	0	0	0	0	0	0	0.034	1626	0.13	0.014	649	-------	-------
OP#1	2060	375	0	0	0	0	245	0.0478	1641	0.1438	0.0085	810	C------	340.13
OP#2	2381	374	2000	0	76	0	142	0.0409	1635	0.1171	0.0094	811	-------	63.78
OP#3	1760	500	0	371	797	0	188	0.0404	1626	0.1119	0.0088	720	-------	43.6
2694	1895	0	0	0	0	693	156	0.041	1679	0.186	0.015	491	-------	-------
AIM	0	0	0	0	0	0	0	0.041	1679	0.19	0.016	491	-------	-------
OP#1	1645	31	0	0	0	0	250	0.0497	1694	0.2038	0.0145	630	C------	153.82
OP#2	1809	1	2000	0	0	817	170	0.0479	1679	0.1895	0.0158	586	-------	36.36
OP#3	1586	495	47	82	1933	0	247	0.0473	1679	0.1874	0.0122	496	-------	17.32
2698	1862	0	0	500	0	601	145	0.038	1671	0.145	0.011	530	-------	-------
AIM	0	0	0	0	0	0	0	0.038	1671	0.19	0.016	530	-------	-------
OP#1	1723	0	0	0	0	0	250	0.0476	1686	0.1841	0.0127	664	C------	181.49
OP#2	1801	29	2000	0	0	622	140	0.0468	1671	0.1694	0.0148	692	C------	113.74
OP#3	1726	500	0	365	1212	0	245	0.0437	1671	0.1519	0.0097	529	-------	35.14
2705	2019	502	0	0	0	526	145	0.043	1676	0.162	0.012	480	-------	-------

AIM	0	0	0	0	0	0	0	0.043	1676	0.21	0.016	480	------	------
OP#1	1770	1	0	0	0	0	250	0.0499	1691	0.1995	0.0133	614	C------	101.47
OP#2	1765	3	2000	0	0	246	149	0.0499	1676	0.1951	0.0156	562	-------	40.25
OP#3	1650	495	0	66	1405	0	250	0.048	1676	0.1821	0.011	478	-------	25.49
2711	1796	0	0	0	0	1518	149	0.042	1643	0.119	0.007	525	------	------
AIM	0	0	0	0	0	0	0	0.042	1643	0.21	0.016	525	------	------
OP#1	1410	50	0	0	0	0	250	0.05	1658	0.1891	0.0114	629	C------	128.77
OP#2	1550	142	2000	0	0	993	141	0.0489	1643	0.1622	0.0123	611	-------	55.74
OP#3	1266	500	0	7	1522	0	233	0.0477	1643	0.1631	0.0102	527	-------	36.47
2719	2546	0	0	0	0	0	160	0.039	1669	0.147	0.012	625	------	------
AIM	0	0	0	0	0	0	0	0.039	1669	0.36	0.076	625	------	------
OP#1	2344	0	0	0	0	0	250	0.0443	1672	0.1551	0.0102	736	-------	91
OP#2	2266	0	8	0	0	0	232	0.0451	1662	0.1672	0.0112	787	-T-----	125.23
OP#3	2662	312	0	876	0	0	247	0.0391	1669	0.1154	0.0069	625	-------	68.54
2724	1585	0	0	0	0	485	148	0.059	1646	0.186	0.016	375	------	------
AIM	0	0	0	0	0	0	0	0.059	1646	0.23	0.021	375	------	------
OP#1	1100	0	0	0	0	0	250	0.0536	1644	0.2041	0.0125	532	-------	65.07
OP#2	1100	1	110	0	0	0	249	0.0584	1644	0.2187	0.0129	375	-------	8.35
OP#3	1151	186	0	181	0	0	249	0.0594	1643	0.1993	0.0118	376	-------	17.02
2726	1817	0	0	0	0	0	152	0.038	1654	0.145	0.007	433	------	------
AIM	0	0	0	0	0	0	0	0.038	1654	0.23	0.021	433	------	------
OP#1	1166	0	0	0	0	0	250	0.0507	1650	0.189	0.0116	595	C------	288.82
OP#2	1361	0	2000	0	0	31	140	0.0499	1650	0.1721	0.0141	595	C------	228.18
OP#3	1730	500	2	939	0	0	250	0.0438	1654	0.1082	0.0065	434	-------	68.94
2728	2064	0	0	309	0	0	144	0.041	1683	0.138	0.01	642	------	------
AIM	0	0	0	0	0	0	0	0.041	1683	0.23	0.021	642	------	------
OP#1	2016	0	0	0	0	0	250	0.0412	1682	0.1566	0.012	803	-------	58.8
OP#2	1723	0	0	0	0	0	140	0.0446	1669	0.1767	0.0164	801	-T-----	160.91
OP#3	1928	312	0	47	0	0	250	0.041	1679	0.1467	0.0114	697	-------	49.19
2730	1626	0	0	534	250	0	140	0.042	1664	0.162	0.017	502	------	------
AIM	0	0	0	0	0	0	0	0.042	1664	0.46	0.021	502	------	------
OP#1	1489	0	0	0	0	0	250	0.0476	1674	0.1801	0.0129	664	-------	123.83
OP#2	1491	0	1996	0	0	94	143	0.0488	1664	0.1875	0.0161	617	-------	98.42
OP#3	1933	430	0	924	1488	0	250	0.042	1664	0.1247	0.008	502	-------	72.95
2733	1663	0	0	772	0	0	150	0.046	1685	0.169	0.018	493	------	------
AIM	0	0	0	0	0	0	0	0.046	1685	0.46	0.016	493	------	------
OP#1	1410	0	0	0	0	0	250	0.0515	1694	0.2039	0.0126	579	-------	98.74
OP#2	1491	1	2000	0	0	231	149	0.0529	1685	0.1858	0.0145	574	-------	91.09
OP#3	1369	500	0	417	2	0	231	0.0467	1685	0.1586	0.0092	494	-------	67.24
2741	1553	0	0	0	0	701	146	0.045	1674	0.192	0.014	486	------	------
AIM	0	0	0	0	0	0	0	0.045	1674	0.46	0.016	486	------	------
OP#1	1296	0	0	0	0	0	250	0.0503	1681	0.2012	0.0131	605	-------	99.93
OP#2	1344	0	1994	0	2	20	142	0.0519	1674	0.1959	0.0159	558	-------	87.75
OP#3	1413	500	0	391	699	0	243	0.0459	1674	0.1544	0.0096	486	-------	68.54
2743	1267	0	0	0	0	1014	150	0.045	1685	0.191	0.015	567	------	------
AIM	0	0	0	0	0	0	0	0.045	1685	0.14	0.013	567	------	------
OP#1	1232	278	0	0	0	0	249	0.0494	1700	0.2044	0.0131	729	--MnP--	354.61
OP#2	1567	0	1984	0	0	2749	188	0.0491	1680	0.1402	0.0109	729	-------	43.23
OP#3	1176	438	1828	723	389	0	209	0.0446	1685	0.14	0.0089	567	-------	1
2745	1681	0	0	512	0	0	155	0.052	1696	0.173	0.014	609	------	------
AIM	0	0	0	0	0	0	0	0.052	1696	0.14	0.013	609	------	------
OP#1	1804	0	0	0	0	0	227	0.0467	1705	0.17	0.0126	747	-------	63.75

OP#2	1921	0	1986	0	0	110	250	0.0487	1691	0.1694	0.0118	634	-------	36.63
OP#3	1928	0	1361	1063	0	0	222	0.0483	1694	0.14	0.0085	609	-------	9.32
2749	2053	0	0	0	0	454	146	0.044	1680	0.186	0.012	468	------	------
AIM	0	0	0	0	0	0	0	0.044	1680	0.18	0.014	468	------	------
OP#1	1845	0	0	0	0	0	250	0.0493	1689	0.1911	0.0132	627	-------	60.97
OP#2	1875	0	1998	0	0	145	187	0.0502	1675	0.1802	0.0139	620	-------	51.8
OP#3	1804	500	0	397	0	0	250	0.046	1679	0.158	0.0099	468	-------	17.71
2751	2366	0	0	0	0	0	149	0.048	1660	0.145	0.011	467	------	------
AIM	0	0	0	0	0	0	0	0.048	1660	0.2	0.016	467	------	------
OP#1	1992	0	0	0	0	0	250	0.0492	1652	0.1588	0.0087	629	-T-----	91.11
OP#2	2026	0	0	0	0	0	230	0.0496	1648	0.1569	0.0089	628	-T-----	137.7
OP#3	2038	250	0	89	0	0	250	0.048	1655	0.1455	0.0082	582	-------	56.81
2753	1729	0	0	496	0	7	161	0.044	1685	0.181	0.012	567	------	------
AIM	0	0	0	0	0	0	0	0.044	1685	0.14	0.013	567	------	------
OP#1	1958	0	0	0	0	0	250	0.0447	1697	0.1712	0.012	728	--Mn---	72.43
OP#2	1880	0	1593	0	0	12	249	0.0494	1680	0.1691	0.0113	729	-------	66.63
OP#3	2002	242	0	701	0	0	250	0.0445	1684	0.1383	0.0081	567	-------	3.18
2755	1769	0	0	748	0	0	160	0.038	1685	0.179	0.012	634	------	------
AIM	0	0	0	0	0	0	0	0.038	1685	0.14	0.013	634	------	------
OP#1	1902	0	0	0	0	0	250	0.0432	1700	0.1643	0.012	759	-------	66.09
OP#2	1880	0	2000	0	0	497	173	0.0452	1681	0.1501	0.013	794	-------	63.45
OP#3	1726	445	0	182	623	0	247	0.0406	1685	0.1396	0.0095	635	-------	7.77
2756	1883	0	0	829	0	0	175	0.043	1665	0.183	0.014	615	------	------
AIM	0	0	0	0	0	0	0	0.043	1665	0.14	0.013	615	------	------
OP#1	1884	0	0	0	0	0	224	0.0459	1680	0.17	0.012	774	-------	68.34
OP#2	2034	0	2000	0	0	915	199	0.045	1665	0.14	0.0111	774	-------	30.51
OP#3	1740	437	579	74	1405	0	243	0.043	1665	0.14	0.0096	615	-------	0.14
2757	1871	0	0	0	0	987	148	0.06	1668	0.165	0.011	470	------	------
AIM	0	0	0	0	0	0	0	0.06	1668	0.41	0.016	470	------	------
OP#1	1420	0	0	0	0	0	250	0.0556	1663	0.1995	0.0118	490	-------	67.85
OP#2	1643	0	0	0	51	0	183	0.0539	1668	0.2009	0.014	470	-------	61.19
OP#3	1513	3	0	5	310	0	248	0.06	1668	0.2161	0.0121	470	-------	47.5
2758	1617	0	0	946	1682	0	155	0.043	1674	0.176	0.011	590	------	------
AIM	0	0	0	0	0	0	0	0.043	1674	0.14	0.013	590	------	------
OP#1	1530	249	0	0	0	0	246	0.0482	1691	0.1954	0.0134	752	-TMnP--	327.87
OP#2	1723	0	2000	0	0	2432	140	0.0471	1669	0.1409	0.0126	726	-------	38.18
OP#3	1474	449	749	773	626	0	209	0.0429	1674	0.1402	0.0096	588	-------	0.67
2759	2168	492	0	0	0	1014	157	0.046	1650	0.15	0.009	420	------	------
AIM	0	0	0	0	0	0	0	0.046	1650	0.41	0.016	420	------	------
OP#1	1911	1	0	0	0	0	250	0.0523	1665	0.1979	0.0122	562	C------	135.41
OP#2	1806	0	1996	0	0	0	154	0.0529	1650	0.1968	0.0139	461	-------	76.83
OP#3	2092	500	0	824	909	0	238	0.0467	1650	0.1427	0.0078	420	-------	66.93
2764	2348	0	0	0	0	1013	140	0.044	1632	0.13	0.007	553	------	------
AIM	0	0	0	0	0	0	0	0.044	1632	0.13	0.014	553	------	------
OP#1	2165	0	0	0	0	0	250	0.0491	1636	0.16	0.0086	631	-------	52.35
OP#2	2346	0	2000	0	0	0	169	0.0443	1629	0.13	0.0087	676	-------	26.05
OP#3	2117	456	0	15	357	0	250	0.0454	1632	0.1298	0.0078	553	-------	3.4
2766	1713	0	0	0	0	1105	181	0.054	1626	0.176	0.011	400	------	------
AIM	0	0	0	0	0	0	0	0 054	1626	0.13	0.014	400	------	------
OP#1	1647	7	2	0	0	0	230	0.055	1642	0.1962	0.011	560	--Mn---	394.24
OP#2	1880	0	1689	0	0	1998	236	0.0528	1622	0.146	0.0066	400	-------	18.75
OP#3	1772	314	1875	900	941	0	216	0.0537	1626	0.13	0.0067	401	-------	0.85

2777	1655	0	0	0	0	1011	160	0.049	1665	0.165	0.012	542	------	------
AIM	0	0	0	0	0	0	0	0.049	1665	0.2	0.016	542	------	------
OP#1	1102	0	2	0	0	0	243	0.0541	1666	0.2145	0.0136	542	-------	18.28
OP#2	1369	125	1750	0	76	70	141	0.0524	1665	0.1989	0.0158	542	-------	7.57
OP#3	1105	453	0	4	467	0	223	0.0493	1665	0.1836	0.0126	540	-------	9.44
2785	2114	0	0	0	0	497	150	0.041	1638	0.135	0.01	638	------	------
AIM	0	0	0	0	0	0	0	0.041	1638	0.13	0.014	638	------	------
OP#1	2065	0	0	0	0	0	250	0.0463	1646	0.1511	0.009	692	-------	46.16
OP#2	2060	0	1875	0	0	0	173	0.0453	1633	0.13	0.0093	642	-------	15.74
OP#3	1726	499	0	0	0	0	222	0.0432	1636	0.1206	0.0089	641	-------	15.53
2787	1807	0	0	925	0	0	161	0.043	1651	0.151	0.009	591	------	------
AIM	0	0	0	0	0	0	0	0.043	1651	0.31	0.013	591	------	------
OP#1	1933	0	0	0	0	0	250	0.0483	1660	0.1708	0.0099	649	-------	76.41
OP#2	1882	0	1992	0	0	0	188	0.0497	1646	0.1505	0.0097	597	-------	73.1
OP#3	1721	500	0	129	0	0	229	0.0438	1651	0.128	0.0083	595	-------	61.75
2790	2271	0	0	542	0	0	157	0.04	1697	0.189	0.019	858	------	------
AIM	0	0	0	0	0	0	0	0.04	1697	0.16	0.014	858	------	------
OP#1	2698	500	0	0	0	0	250	0.0412	1712	0.1802	0.0143	986	----P--	70.14
OP#2	2710	0	1754	0	0	497	249	0.0398	1692	0.165	0.0134	858	-------	8.45
OP#3	2615	2	311	710	1171	0	207	0.0398	1697	0.1601	0.0125	857	-------	0.6
2796	2011	0	0	832	0	0	163	0.04	1675	0.179	0.012	842	------	------
AIM	0	0	0	0	0	0	0	0.04	1675	0.16	0.014	842	------	------
OP#1	2261	500	0	0	0	0	250	0.0404	1690	0.1851	0.0141	1004	----P--	58.57
OP#2	2195	31	2000	0	37	0	222	0.0415	1675	0.1583	0.0134	842	-------	4.95
OP#3	1726	280	0	70	154	0	198	0.0399	1675	0.1508	0.0136	845	-------	6.34
2803	1450	0	0	909	1820	0	162	0.043	1650	0.176	0.011	463	------	------
AIM	0	0	0	0	0	0	0	0.043	1650	0.21	0.014	463	------	------
OP#1	1183	0	0	0	0	0	250	0.0531	1665	0.2079	0.0124	544	C------	168.21
OP#2	1520	0	2000	0	0	2248	140	0.0504	1650	0.1418	0.0113	625	C------	95.55
OP#3	1217	498	0	301	1447	0	233	0.049	1650	0.1582	0.0093	461	-------	39.28
2805	1843	0	0	0	0	773	158	0.05	1666	0.174	0.014	476	------	------
AIM	0	0	0	0	0	0	0	0.05	1666	0.21	0.014	476	------	------
OP#1	1471	0	0	0	0	0	250	0.0525	1661	0.2086	0.0135	558	-------	27.94
OP#2	1569	0	76	0	0	0	236	0.0538	1661	0.1948	0.0132	495	-------	23.8
OP#3	1493	244	2	11	7	0	247	0.0543	1664	0.1779	0.0118	478	-------	26.58
2811	2226	0	0	953	244	0	159	0.05	1657	0.149	0.008	489	------	------
AIM	0	0	0	0	0	0	0	0.05	1657	0.21	0.014	489	------	------
OP#1	1437	0	0	0	0	0	250	0.0552	1652	0.1969	0.0107	497	-------	23.29
OP#2	1432	0	41	0	0	0	152	0.0566	1654	0.1888	0.0132	489	-------	26.34
OP#3	1569	247	0	1	154	0	248	0.0537	1657	0.1698	0.0096	487	-------	26.96
2813	2176	0	0	527	0	0	161	0.047	1667	0.15	0.009	521	------	------
AIM	0	0	0	0	0	0	0	0.047	1667	0.21	0.014	521	------	------
OP#1	1818	0	0	0	0	0	250	0.0523	1665	0.1832	0.0102	562	-------	33.97
OP#2	1882	0	311	0	0	0	236	0.0538	1662	0.1668	0.0097	604	-------	55.63
OP#3	1882	422	0	86	0	0	250	0.047	1666	0.1418	0.0081	526	-------	34.31
2815	2680	0	0	0	0	1763	151	0.042	1632	0.113	0.007	729	------	------
AIM	0	0	0	0	0	0	0	0.042	1632	0.13	0.014	729	------	------
OP#1	2828	36	0	0	0	0	176	0.0473	1664	0.1601	0.0117	890	-T-----	256.46
OP#2	2674	94	1001	0	78	2002	141	0.044	1632	0.1288	0.01	729	-------	5.64
OP#3	2310	373	1001	881	418	0	161	0.042	1632	0.1299	0.0102	730	-------	0.3
2818	2736	0	0	0	0	0	165	0.034	1700	0.12	0.008	643	------	------
AIM	0	0	0	0	0	0	0	0.034	1700	0.21	0.011	643	------	------

OP#1	2508	0	0	0	0	0	250	0.041	1696	0.137	0.0103	808	C------	140
OP#2	2410	0	2000	0	0	0	195	0.0418	1673	0.1295	0.0107	811	CT-----	373.53
OP#3	2510	373	2	131	0	0	250	0.034	1696	0.1094	0.0087	796	-------	75.41
2828	1680	0	0	750	0	513	159	0.045	1692	0.132	0.007	558	------	------
AIM	0	0	0	0	0	0	0	0.045	1692	0.21	0.011	558	------	------
OP#1	1503	7	0	0	0	0	250	0.0468	1692	0.1851	0.0126	683	----P--	184.05
OP#2	1674	0	1977	0	0	665	250	0.0496	1679	0.161	0.011	720	-T-----	159.48
OP#3	1413	375	0	41	0	0	250	0.0454	1687	0.165	0.0108	585	-------	31.87
2832	1917	0	0	504	0	0	140	0.035	1680	0.131	0.01	610	------	------
AIM	0	0	0	0	0	0	0	0.035	1680	0.21	0.011	610	------	------
OP#1	1843	0	0	0	0	0	250	0.0426	1693	0.1719	0.0131	773	C---P--	339.96
OP#2	1882	0	2000	0	0	755	250	0.0457	1671	0.1479	0.011	772	CT-----	240.83
OP#3	1564	500	0	86	46	0	247	0.0414	1680	0.1435	0.0108	609	-------	50.46
2834	2113	0	0	0	0	702	145	0.045	1635	0.139	0.008	528	------	------
AIM	0	0	0	0	0	0	0	0.045	1635	0.13	0.014	528	------	------
OP#1	2036	0	0	0	0	0	243	0.0474	1648	0.1698	0.0115	689	--Mn---	154.77
OP#2	2192	0	2000	0	0	997	216	0.045	1631	0.131	0.0091	684	-------	33.91
OP#3	2068	301	4	702	230	0	234	0.0469	1635	0.1299	0.0088	529	-------	4.56
2836	2527	0	0	0	0	0	157	0.043	1691	0.128	0.009	693	------	------
AIM	0	0	0	0	0	0	0	0.043	1691	0.91	0.012	693	------	------
OP#1	2165	18	10	0	0	0	249	0.0467	1691	0.1576	0.0106	694	-------	91.45
OP#2	2278	0	483	0	0	0	168	0.0452	1686	0.1378	0.0119	814	-------	112.5
OP#3	2295	135	8	454	0	0	243	0.043	1691	0.1237	0.0078	694	-------	86.61
2846	2576	0	0	889	1944	0	160	0.048	1652	0.14	0.006	457	------	------
AIM	0	0	0	0	0	0	0	0.048	1652	0.21	0.014	457	------	------
OP#1	1985	0	0	0	0	0	250	0.0533	1652	0.1807	0.0091	540	-------	43.33
OP#2	1882	0	53	0	0	0	167	0.0548	1647	0.1685	0.0101	570	-------	63.63
OP#3	1906	500	0	73	0	0	250	0.0482	1647	0.1395	0.0069	470	-------	42.23
2848	2070	0	0	851	3258	0	148	0.03	1642	0.075	0.004	650	------	------
AIM	0	0	0	0	0	0	0	0.03	1642	0.13	0.014	650	------	------
OP#1	1770	0	0	0	0	0	250	0.0408	1647	0.132	0.0074	812	C------	251.81
OP#2	1784	0	2000	0	0	0	143	0.0415	1637	0.0773	0.0072	833	C----O-	296.46
OP#3	1743	500	0	174	293	0	250	0.0365	1642	0.0341	0.003	687	-------	103.5
2854	1657	0	0	0	0	0	161	0.033	1673	0.136	0.01	784	------	------
AIM	0	0	0	0	0	0	0	0.033	1673	0.19	0.016	784	------	------
OP#1	1880	0	0	0	0	0	140	0.0383	1679	0.1412	0.0117	811	-------	52.16
OP#2	1765	50	452	0	64	0	140	0.0396	1673	0.1236	0.0111	784	-------	54.88
OP#3	1782	125	4	1	1562	0	140	0.0331	1673	0.1077	0.0102	784	-------	43.82
2856	2315	0	0	0	0	450	157	0.052	1662	0.171	0.012	449	------	------
AIM	0	0	0	0	0	0	0	0.052	1662	0.41	0.016	449	------	------
OP#1	2029	0	0	0	0	0	140	0.0509	1657	0.1856	0.0135	568	-------	88.34
OP#2	2038	0	1155	0	0	0	250	0.0517	1658	0.1874	0.0116	449	-------	59.11
OP#3	1726	33	0	38	0	0	156	0.052	1657	0.2081	0.0143	498	-------	65.17
2858	2101	0	0	0	0	0	152	0.047	1681	0.176	0.014	498	------	------
AIM	0	0	0	0	0	0	0	0.047	1681	0.41	0.016	498	------	------
OP#1	1767	0	0	0	0	0	140	0.0461	1664	0.1723	0.0129	660	-T-----	231.95
OP#2	1723	0	0	0	0	0	250	0.0497	1670	0.187	0.0127	652	-T-----	160.57
OP#3	1728	203	0	4	0	0	164	0.0407	1673	0.1604	0.0129	660	-T-----	141.38
2860	1991	0	0	0	0	0	153	0.05	1693	0.245	0.02	496	------	------
AIM	0	0	0	0	0	0	0	0.05	1693	0.19	0.016	496	------	------
OP#1	1880	0	0	0	0	0	181	0.0494	1692	0.2195	0.0165	656	----P--	81.88
OP#2	2078	0	2000	0	0	0	250	0.0475	1688	0.2129	0.0155	542	-------	30.89

OP#3	2002	104	1312	809	0	0	216	0.0499	1688	0.19	0.013	570	-------	20.29
2866	2819	0	0	0	0	0	158	0.033	1671	0.115	0.007	672	------	------
AIM	0	0	0	0	0	0	0	0.033	1671	0.2	0.016	672	------	------
OP#1	2867	0	0	0	0	0	140	0.0336	1666	0.1025	0.0088	904	-----O-	194.14
OP#2	2315	0	194	0	0	0	181	0.0387	1646	0.1201	0.0091	834	-T-----	307.33
OP#3	2593	125	0	44	0	0	140	0.0303	1665	0.096	0.01	834	-T-----	103.43
2868	2250	0	0	0	0	1499	164	0.045	1648	0.121	0.005	469	------	------
AIM	0	0	0	0	0	0	0	0.045	1648	0.2	0.016	469	------	------
OP#1	1821	0	0	0	0	0	140	0.0503	1655	0.1424	0.0083	580	-------	70.88
OP#2	1767	0	1992	0	0	0	140	0.0519	1647	0.1336	0.008	522	-------	61.08
OP#3	1276	329	2	4	0	0	154	0.045	1643	0.1451	0.0089	501	-------	39.18
2870	2238	0	0	0	0	10	158	0.039	1674	0.165	0.011	550	------	------
AIM	0	0	0	0	0	0	0	0.039	1674	0.2	0.016	550	------	------
OP#1	2258	0	0	0	0	0	140	0.0435	1673	0.1535	0.0119	711	-------	65.42
OP#2	2217	0	1439	0	0	0	250	0.0451	1668	0.156	0.0106	712	-------	82.82
OP#3	1960	196	0	16	0	0	140	0.039	1670	0.1549	0.013	640	-------	43.16
2872	2296	0	0	0	0	0	166	0.043	1678	0.164	0.011	544	------	------
AIM	0	0	0	0	0	0	0	0.043	1678	0.2	0.016	544	------	------
OP#1	2036	0	0	0	0	0	140	0.0438	1657	0.1549	0.012	706	-T-----	236.45
OP#2	1867	0	14	0	0	0	245	0.048	1658	0.1702	0.0123	706	-T-----	225.35
OP#3	1990	328	0	1	0	0	174	0.0366	1667	0.1336	0.0121	706	-T-----	150.12
2874	2201	0	0	0	0	501	155	0.045	1660	0.156	0.008	424	------	------
AIM	0	0	0	0	0	0	0	0.045	1660	0.2	0.016	424	------	------
OP#1	1855	0	0	0	0	0	140	0.0503	1656	0.1667	0.0113	580	-------	68.97
OP#2	1726	0	182	0	0	0	141	0.0518	1655	0.1817	0.0126	506	-------	48.55
OP#3	1569	187	2	10	0	0	140	0.0454	1655	0.174	0.0123	523	-------	42.3
2887	2606	0	0	0	0	0	156	0.041	1687	0.161	0.012	568	------	------
AIM	0	0	0	0	0	0	0	0.041	1687	0.26	0.016	568	------	------
OP#1	2410	0	0	0	0	0	140	0.0425	1668	0.1464	0.0118	731	-T-----	235.96
OP#2	2300	0	8	0	0	0	250	0.044	1668	0.1555	0.0106	730	-T-----	236.12
OP#3	2349	232	0	0	0	0	160	0.0359	1678	0.1348	0.0117	730	-T-----	135.92
2891	2258	0	0	0	0	0	153	0.036	1680	0.149	0.011	585	------	------
AIM	0	0	0	0	0	0	0	0.036	1680	0.26	0.016	585	------	------
OP#1	2427	0	0	0	0	0	140	0.0414	1675	0.1558	0.0125	752	-------	100.08
OP#2	2341	0	1255	0	0	0	250	0.0426	1669	0.1394	0.0099	747	-T-----	167.18
OP#3	2351	117	0	179	0	0	140	0.036	1678	0.1341	0.0123	716	-------	72.96
2893	1993	0	0	0	0	0	168	0.038	1669	0.118	0.006	494	------	------
AIM	0	0	0	0	0	0	0	0.038	1669	0.26	0.016	494	------	------
OP#1	1613	0	0	0	0	0	140	0.0433	1659	0.1394	0.0106	715	-T---O-	280.19
OP#2	1667	0	1435	0	0	0	166	0.0441	1659	0.1425	0.0105	656	-T-----	148.92
OP#3	1471	483	2	25	0	0	141	0.0316	1664	0.1135	0.01	656	-------	115.03
2895	1506	0	0	451	0	3	155	0.047	1683	0.184	0.013	466	------	------
AIM	0	0	0	0	0	0	0	0.047	1683	0.26	0.016	466	------	------
OP#1	1310	0	0	0	0	0	140	0.0478	1676	0.1899	0.0138	628	-T-----	94.84
OP#2	1256	0	336	0	0	0	140	0.0507	1678	0.2048	0.0158	569	-------	56.38
OP#3	1139	72	2	15	0	0	175	0.047	1678	0.1897	0.0136	621	-------	65.35
2897	1616	0	0	0	0	0	154	0.042	1669	0.162	0.01	501	------	------
AIM	0	0	0	0	0	0	0	0.042	1669	0.26	0.016	501	------	------
OP#1	1410	0	0	0	0	0	143	0.0463	1658	0.175	0.0119	662	-T-----	149.7
OP#2	1405	0	61	0	0	0	154	0.048	1664	0.1773	0.013	651	-------	81.39
OP#3	1413	38	0	96	0	0	140	0.042	1664	0.1588	0.012	645	-------	72.64
2899	1690	0	0	621	618	0	156	0.04	1668	0.153	0.011	533	------	------

AIM	0	0	0	0	0	0	0	0.04	1668	0.26	0.016	533	------	------
OP#1	1633	0	0	0	0	0	140	0.0448	1668	0.1646	0.0128	686	-------	77.64
OP#2	1650	0	1713	0	2	0	140	0.0445	1663	0.1641	0.0128	533	-------	52.65
OP#3	1259	375	0	0	0	0	140	0.0401	1663	0.1606	0.0125	544	-------	45.36
2906	1670	0	0	0	0	750	148	0.046	1667	0.161	0.009	460	------	------
AIM	0	0	0	0	0	0	0	0.046	1667	0.26	0.016	460	------	------
OP#1	1540	0	0	0	0	0	140	0.0499	1662	0.1746	0.0124	587	-------	74.03
OP#2	1423	0	248	0	0	0	140	0.0529	1662	0.189	0.0135	478	-------	50.9
OP#3	1335	93	0	81	0	0	140	0.0461	1662	0.1774	0.0128	545	-------	55.26
2914	1847	0	0	0	0	0	176	0.049	1675	0.185	0.013	603	------	------
AIM	0	0	0	0	0	0	0	0.049	1675	0.16	0.014	603	------	------
OP#1	1801	0	0	0	0	0	140	0.0438	1673	0.1606	0.0128	706	-------	30.47
OP#2	1821	0	1918	0	0	4	250	0.0463	1670	0.1705	0.0116	612	-------	18.63
OP#3	1427	139	1752	142	0	0	230	0.049	1670	0.16	0.0106	664	-------	15.07
2923	2356	0	0	0	0	643	168	0.048	1660	0.168	0.01	467	------	------
AIM	0	0	0	0	0	0	0	0.048	1660	0.21	0.014	467	------	------
OP#1	2126	0	0	0	0	0	140	0.0495	1655	0.1776	0.0116	596	-------	51.1
OP#2	1975	0	35	0	0	0	210	0.052	1655	0.1754	0.0111	599	-------	57.89
OP#3	2038	0	0	349	0	0	159	0.0476	1655	0.1695	0.0115	573	-------	47.81
2925	2507	0	0	0	0	0	177	0.045	1684	0.119	0.007	741	------	------
AIM	0	0	0	0	0	0	0	0.045	1684	0.21	0.014	741	------	------
OP#1	2297	0	0	0	0	0	226	0.04	1679	0.1198	0.0077	902	-------	80.62
OP#2	2192	0	0	0	0	0	250	0.0437	1671	0.1243	0.0073	898	-T-----	163.23
OP#3	2195	0	0	105	0	0	229	0.0397	1679	0.1114	0.0073	903	-------	85.4
2931	1886	0	0	0	0	111	169	0.039	1672	0.183	0.023	757	------	------
AIM	0	0	0	0	0	0	0	0.039	1672	0.21	0.014	757	------	------
OP#1	2403	156	29	0	0	0	140	0.0443	1682	0.1578	0.0129	757	-------	48.13
OP#2	2349	156	0	0	547	0	145	0.0419	1672	0.1643	0.013	751	-------	29.88
OP#3	2398	2	0	0	2500	0	154	0.0391	1677	0.1557	0.0126	757	-------	31.36
2932	1773	0	0	0	0	242	175	0.06	1655	0.193	0.012	516	------	------
AIM	0	0	0	0	0	0	0	0.06	1655	0.21	0.014	516	------	------
OP#1	1474	0	0	0	0	0	242	0.0571	1650	0.1946	0.0113	594	-------	32.35
OP#2	1804	127	31	0	286	0	250	0.0557	1655	0.1853	0.0106	516	-------	16.97
OP#3	1305	16	6	8	0	0	230	0.06	1650	0.21	0.0117	523	-------	6.44
2937	1521	0	0	0	0	211	187	0.055	1643	0.177	0.012	562	------	------
AIM	0	0	0	0	0	0	0	0.055	1643	0.21	0.014	562	------	------
OP#1	1217	0	0	0	0	0	240	0.0526	1638	0.185	0.0103	679	-------	42.56
OP#2	1413	93	198	0	115	0	250	0.0545	1643	0.1842	0.0107	562	-------	13.26
OP#3	1110	21	0	4	0	0	210	0.055	1638	0.1895	0.0113	571	-------	16.12
2941	1847	0	0	0	0	0	167	0.044	1628	0.156	0.008	687	------	------
AIM	0	0	0	0	0	0	0	0.044	1628	0.13	0.014	687	------	------
OP#1	2012	0	0	0	0	0	140	0.044	1628	0.1347	0.0087	701	-------	5.74
OP#2	1997	0	1124	0	0	227	191	0.044	1626	0.13	0.008	688	-------	1.73
OP#3	1882	97	373	212	762	0	192	0.0439	1628	0.1301	0.0082	688	-------	0.28
2943	1243	0	0	0	0	235	184	0.045	1662	0.124	0.008	709	------	------
AIM	0	0	0	0	0	0	0	0.045	1662	0.26	0.013	709	------	------
OP#1	1325	188	170	0	0	0	141	0.0482	1662	0.156	0.0104	709	-------	47.18
OP#2	1555	368	1222	0	152	0	140	0.0469	1662	0.1509	0.0104	709	-------	46.18
OP#3	1254	95	0	0	1562	0	198	0.045	1662	0.149	0.0092	701	-------	44.03
2944	1589	0	0	0	0	0	196	0.054	1655	0.203	0.012	516	------	------
AIM	0	0	0	0	0	0	0	0.054	1655	0.26	0.013	516	------	------
OP#1	1256	0	0	0	0	0	140	0.0532	1650	0.1845	0.0112	523	-------	37.08

OP#2	1254	3	51	0	301	0	140	0.0555	1655	0.1923	0.0129	516	-------	28.79
OP#3	1100	0	0	218	0	0	183	0.054	1650	0.1881	0.011	519	-------	32.97
2946	1935	0	0	0	0	0	185	0.043	1663	0.154	0.009	695	------	------
AIM	0	0	0	0	0	0	0	0.043	1663	0.26	0.013	695	------	------
OP#1	1919	0	0	0	0	0	140	0.0433	1663	0.137	0.0101	716	-------	51.26
OP#2	1892	0	514	0	0	0	143	0.043	1662	0.1418	0.0107	697	-------	46.59
OP#3	1665	38	0	44	137	0	169	0.043	1663	0.1454	0.0104	695	-------	44.15
2948	2190	0	0	0	0	0	189	0.038	1671	0.093	0.005	794	------	------
AIM	0	0	0	0	0	0	0	0.038	1671	0.23	0.021	794	------	------
OP#1	2388	0	0	0	0	0	140	0.0389	1671	0.0976	0.0075	800	-------	61.01
OP#2	2351	0	561	0	0	0	150	0.038	1667	0.1065	0.0078	906	-------	72.28
OP#3	1980	15	0	0	0	0	168	0.038	1667	0.1168	0.0086	801	-------	54.5
2952	1808	0	0	1010	0	118	172	0.04	1642	0.121	0.012	852	------	------
AIM	0	0	0	0	0	0	0	0.04	1642	0.13	0.014	852	------	------
OP#1	2192	428	0	0	0	0	140	0.0443	1657	0.1344	0.0106	852	-------	28.98
OP#2	2329	366	150	0	1395	497	157	0.04	1642	0.1303	0.0088	852	-------	0.26
OP#3	2046	196	753	1	2500	0	182	0.04	1654	0.13	0.0093	716	-------	27.64
2954	2008	0	0	947	0	0	177	0.041	1657	0.137	0.012	790	------	------
AIM	0	0	0	0	0	0	0	0.041	1657	0.23	0.013	790	------	------
OP#1	2102	250	328	0	0	0	141	0.046	1657	0.1563	0.0119	791	-------	44.47
OP#2	2280	187	57	0	780	12	168	0.0412	1657	0.1519	0.0112	790	-------	34.45
OP#3	2227	9	0	0	2500	0	161	0.041	1660	0.1493	0.0113	732	-------	45.33
2958	1307	0	0	820	0	0	200	0.048	1693	0.165	0.016	694	------	------
AIM	0	0	0	0	0	0	0	0.048	1693	0.19	0.013	694	------	------
OP#1	1254	94	0	0	0	0	202	0.0506	1698	0.1902	0.013	697	------	10.72
OP#2	1596	81	1022	0	863	98	168	0.0488	1693	0.1805	0.013	694	------	6.38
OP#3	1237	0	0	1	1408	0	202	0.048	1693	0.1844	0.0121	695	------	3.12
2960	2308	0	0	0	0	0	200	0.042	1650	0.091	0.004	840	------	------
AIM	0	0	0	0	0	0	0	0.042	1650	0.19	0.013	840	------	------
OP#1	1960	0	0	0	0	0	237	0.042	1645	0.1143	0.0065	879	-------	49.36
OP#2	2117	0	0	0	0	0	250	0.0416	1648	0.1174	0.0066	840	-------	41.04
OP#3	1968	0	0	0	389	0	216	0.042	1650	0.1145	0.0073	840	-------	39.89
2965	1983	0	0	0	0	0	217	0.037	1690	0.102	0.007	1120	------	------
AIM	0	0	0	0	0	0	0	0.037	1690	0.19	0.013	1120	------	------
OP#1	2185	364	135	0	0	0	246	0.0378	1690	0.1072	0.0078	1120	-------	45.86
OP#2	2349	4	0	0	108	0	224	0.037	1690	0.1022	0.0084	1075	-------	50.32
OP#3	2082	9	2	0	589	0	237	0.037	1690	0.0973	0.0079	977	-------	61.64
2967	1270	0	0	0	0	0	205	0.048	1679	0.159	0.009	725	------	------
AIM	0	0	0	0	0	0	0	0.048	1679	0.19	0.013	725	------	------
OP#1	1354	0	0	0	0	0	213	0.0482	1679	0.1706	0.0114	725	-------	10.72
OP#2	1586	217	2	0	259	0	194	0.0481	1679	0.1747	0.0122	725	-------	8.14
OP#3	1293	0	0	0	604	0	223	0.049	1679	0.172	0.0109	724	-------	11.69
2969	1661	0	0	0	0	0	207	0.044	1679	0.134	0.012	788	------	------
AIM	0	0	0	0	0	0	0	0.044	1679	0.19	0.013	788	------	------
OP#1	1726	0	0	0	0	0	206	0.0432	1674	0.1411	0.0089	811	-------	35.37
OP#2	1806	0	0	0	2	0	197	0.044	1675	0.1448	0.0097	787	-------	27.66
OP#3	1726	0	0	270	0	0	222	0.044	1676	0.1316	0.0077	791	-------	34.22
2973	1313	0	0	0	0	0	192	0.043	1657	0.156	0.009	752	------	------
AIM	0	0	0	0	0	0	0	0.043	1657	0.19	0.013	752	------	------
OP#1	1459	70	280	0	0	0	177	0.0471	1657	0.1568	0.0104	752	-------	27.01
OP#2	1586	241	14	0	215	0	140	0.0465	1657	0.1582	0.0114	752	-------	24.99
OP#3	1489	1	0	0	1552	0	198	0.0446	1657	0.1473	0.0097	751	-------	26.25

2975	1809	0	0	0	0	0	188	0.046	1654	0.167	0.02	904	------	------
AIM	0	0	0	0	0	0	0	0.046	1654	0.23	0.016	904	------	------
OP#1	1904	86	594	0	0	0	246	0.0463	1654	0.1593	0.0109	904	-------	31.5
OP#2	2327	5	0	0	1229	0	250	0.0406	1654	0.1286	0.0081	868	-------	59.76
OP#3	2129	3	0	0	2495	0	240	0.046	1654	0.1381	0.0084	816	-------	49.73
2980	1582	0	0	400	0	0	195	0.046	1677	0.184	0.012	714	------	------
AIM	0	0	0	0	0	0	0	0.046	1677	0.23	0.016	714	------	------
OP#1	1748	161	47	0	0	0	144	0.0469	1677	0.1666	0.0111	715	-------	29.72
OP#2	1801	6	1032	0	95	0	140	0.0466	1677	0.1613	0.0118	714	-------	31.34
OP#3	1555	30	0	3	645	0	200	0.046	1677	0.1651	0.0105	714	-------	28.39
2984	1520	0	0	0	0	0	189	0.048	1670	0.159	0.015	692	------	------
AIM	0	0	0	0	0	0	0	0.048	1670	0.14	0.013	692	------	------
OP#1	1689	0	0	0	0	0	145	0.0438	1677	0.1699	0.013	712	-------	39.69
OP#2	1748	0	1998	0	0	1122	250	0.0464	1665	0.1522	0.0103	692	-------	17.03
OP#3	1662	55	1687	762	467	0	243	0.048	1670	0.1401	0.0088	692	-------	0.11
2986	1415	0	0	266	0	91	191	0.052	1678	0.198	0.015	592	------	------
AIM	0	0	0	0	0	0	0	0.052	1678	0.14	0.013	592	------	------
OP#1	1784	344	0	0	0	0	140	0.0479	1693	0.1761	0.0136	752	--MnP--	169.29
OP#2	1784	0	2000	0	0	1998	250	0.0519	1674	0.1481	0.0092	593	-------	10.3
OP#3	1765	63	1857	1306	765	0	250	0.0512	1678	0.14	0.0072	592	-------	1.57
2990	2142	0	0	608	0	0	198	0.057	1660	0.16	0.009	406	------	------
AIM	0	0	0	0	0	0	0	0.057	1660	0.2	0.016	406	------	------
OP#1	1845	0	0	0	0	0	140	0.0562	1655	0.1901	0.0133	466	-------	26.45
OP#2	1806	0	12	0	0	0	171	0.057	1659	0.1948	0.0138	406	-------	3.97
OP#3	1569	61	592	156	0	0	195	0.057	1655	0.2	0.0131	469	-------	20.54
2994	1848	0	0	0	0	0	198	0.056	1667	0.209	0.018	566	------	------
AIM	0	0	0	0	0	0	0	0.056	1667	0.2	0.016	566	------	------
OP#1	1647	0	0	0	0	0	230	0.0546	1662	0.1985	0.0126	625	-------	18.64
OP#2	1882	31	235	0	27	0	250	0.054	1667	0.1906	0.0129	566	-------	8.35
OP#3	1608	0	22	174	0	0	220	0.0558	1662	0.2	0.0131	571	-------	5.97
2996	2260	0	0	0	0	545	192	0.041	1633	0.145	0.01	755	------	------
AIM	0	0	0	0	0	0	0	0.041	1633	0.13	0.014	755	------	------
OP#1	2720	132	2	0	0	0	140	0.0437	1648	0.1352	0.0088	755	-------	25.68
OP#2	2559	285	751	0	59	0	142	0.0413	1633	0.1299	0.0086	755	-------	0.82
OP#3	2613	80	111	78	2500	0	187	0.041	1640	0.13	0.0084	752	-------	7.53
3004	1827	0	0	746	0	0	202	0.057	1666	0.2	0.019	489	------	------
AIM	0	0	0	0	0	0	0	0.057	1666	0.18	0.014	489	------	------
OP#1	1611	0	0	0	0	0	140	0.0544	1661	0.1948	0.0126	502	-------	20.38
OP#2	1713	0	989	0	0	414	250	0.0565	1664	0.1827	0.0104	489	-------	4.07
OP#3	1342	125	2000	174	0	0	223	0.0564	1661	0.1804	0.01	512	-------	10.74
3008	1831	0	0	893	854	805	199	0.049	1708	0.177	0.014	872	------	------
AIM	0	0	0	0	0	0	0	0.049	1708	0.41	0.016	872	------	------
OP#1	1880	475	829	0	0	0	152	0.0497	1708	0.1894	0.0158	871	-------	55.43
OP#2	2143	67	68	0	1559	0	245	0.049	1708	0.1879	0.0129	872	-------	54.2
OP#3	1821	0	0	3	2187	0	250	0.049	1708	0.1886	0.0122	782	-------	64.85
3010	2231	0	0	0	0	1029	201	0.055	1662	0.168	0.01	523	------	------
AIM	0	0	0	0	0	0	0	0.055	1662	0.18	0.014	523	------	------
OP#1	2031	0	6	0	0	0	161	0.0548	1662	0.1828	0.0119	523	-------	1.91
OP#2	2090	65	522	0	83	0	219	0.055	1662	0.1778	0.0109	523	-------	1.33
OP#3	1765	55	1476	163	0	0	202	0.055	1660	0.18	0.011	524	-------	2.15
3017	2276	0	0	0	0	544	202	0.043	1675	0.14	0.01	1144	------	------
AIM	0	0	0	0	0	0	0	0.043	1675	0.18	0.014	1144	------	------

OP#1	2351	500	1500	0	0	0	249	0.0471	1675	0.1506	0.0114	1144	-------	25.87
OP#2	2740	0	0	0	1251	0	250	0.0416	1674	0.1244	0.0077	1001	-------	47.64
OP#3	2820	0	0	4	2500	0	250	0.0385	1688	0.1142	0.0079	982	-------	74.06
3019	1740	0	0	0	0	0	206	0.049	1657	0.166	0.011	773	------	------
AIM	0	0	0	0	0	0	0	0.049	1657	0.21	0.014	773	------	------
OP#1	1437	2	88	0	0	0	250	0.049	1656	0.1637	0.0088	773	-------	23.59
OP#2	1726	232	141	0	108	0	243	0.049	1657	0.1504	0.0082	773	-------	28.41
OP#3	1508	0	0	0	858	0	245	0.049	1657	0.15	0.0079	772	-------	28.96
3021	1717	0	0	0	0	407	205	0.045	1658	0.153	0.01	687	------	------
AIM	0	0	0	0	0	0	0	0.045	1658	0.21	0.014	687	------	------
OP#1	1892	12	51	0	0	0	143	0.0455	1658	0.1574	0.0115	687	-------	26.32
OP#2	1884	157	29	0	0	0	157	0.045	1658	0.1726	0.0126	687	-------	17.91
OP#3	1726	108	0	22	948	0	195	0.045	1658	0.165	0.0111	687	-------	21.46
3027	2233	0	0	0	0	0	189	0.041	1630	0.11	0.007	870	------	------
AIM	0	0	0	0	0	0	0	0.041	1630	0.13	0.014	870	------	------
OP#1	2273	147	65	0	0	0	247	0.0463	1630	0.129	0.0061	871	-------	13.81
OP#2	2544	16	0	0	611	0	224	0.0411	1630	0.1083	0.0055	870	-------	16.88
OP#3	2522	0	0	0	2490	0	199	0.041	1630	0.1097	0.0065	821	-------	21.26
3028	2126	0	0	0	0	0	189	0.045	1630	0.124	0.007	737	------	------
AIM	0	0	0	0	0	0	0	0.045	1630	0.13	0.014	737	------	------
OP#1	2239	124	121	0	0	0	144	0.0455	1630	0.1299	0.0084	736	-------	1.45
OP#2	2351	124	1062	0	384	0	250	0.0441	1630	0.1205	0.0057	737	-------	9.48
OP#3	2185	8	375	5	2187	0	197	0.045	1630	0.1299	0.0076	737	-------	0.23
3030	1442	0	0	0	0	1012	204	0.051	1655	0.175	0.012	635	------	------
AIM	0	0	0	0	0	0	0	0.051	1655	0.18	0.014	635	------	------
OP#1	1256	250	0	0	0	0	140	0.0522	1659	0.1816	0.0122	635	-------	7.53
OP#2	1410	336	125	0	855	375	140	0.052	1655	0.1796	0.0121	635	-------	2.19
OP#3	1212	11	156	5	2500	0	203	0.051	1656	0.18	0.0108	635	-------	1.04
3034	1641	0	0	0	0	108	204	0.052	1656	0.208	0.018	527	------	------
AIM	0	0	0	0	0	0	0	0.052	1656	0.23	0.016	527	------	------
OP#1	1410	0	0	0	0	0	166	0.052	1651	0.1914	0.0123	584	-------	32.97
OP#2	1528	161	192	0	20	0	188	0.052	1656	0.1995	0.0132	527	-------	13.3
OP#3	1278	31	0	0	0	0	168	0.0521	1655	0.2025	0.0133	527	-------	13.63
3035	1515	0	0	0	0	0	215	0.049	1672	0.2	0.016	726	------	------
AIM	0	0	0	0	0	0	0	0.049	1672	0.23	0.016	726	------	------
OP#1	1325	0	29	0	0	0	222	0.049	1667	0.1966	0.0123	725	-------	19.26
OP#2	1579	124	0	0	271	0	240	0.049	1672	0.199	0.0132	726	-------	13.49
OP#3	1479	13	0	0	921	0	227	0.049	1672	0.1849	0.0118	726	-------	19.68
3039	1605	0	0	0	0	604	204	0.059	1687	0.219	0.02	617	------	------
AIM	0	0	0	0	0	0	0	0.059	1687	0.2	0.016	617	------	------
OP#1	1337	0	4	0	0	0	212	0.0537	1682	0.2194	0.0151	617	-------	23.61
OP#2	1716	0	0	0	0	997	250	0.0521	1687	0.2038	0.014	616	-------	13.77
OP#3	1361	44	2000	174	59	0	250	0.0559	1687	0.2002	0.0125	617	-------	5.4
3052	2349	0	0	0	0	0	211	0.04	1673	0.142	0.013	953	------	------
AIM	0	0	0	0	0	0	0	0.04	1673	0.41	0.016	953	------	------
OP#1	2381	398	530	0	0	0	140	0.0415	1673	0.1336	0.0112	952	-------	71.32
OP#2	2508	373	498	0	56	51	250	0.04	1673	0.1207	0.0084	955	-------	70.89
OP#3	2361	7	2	5	2500	0	216	0.04	1674	0.1231	0.0092	874	-------	79.05
3066	2156	0	0	989	0	0	207	0.049	1664	0.143	0.01	762	------	------
AIM	0	0	0	0	0	0	0	0.049	1664	0.46	0.016	762	------	------
OP#1	1958	156	198	0	0	0	197	0.0491	1664	0.1683	0.0116	763	-------	63.76
OP#2	2185	31	16	0	982	0	250	0.0475	1664	0.1509	0.0092	762	-------	70.25

OP#3	2002	10	0	16	2151	0	243	0.049	1664	0.1579	0.0093	762	------	65.74
3067	1830	0	0	579	0	0	217	0.048	1674	0.16	0.011	669	------	------
AIM	0	0	0	0	0	0	0	0.048	1674	0.21	0.014	669	------	------
OP#1	1569	7	22	0	0	0	218	0.0517	1674	0.1918	0.0113	669	------	16.49
OP#2	1762	62	16	0	154	16	140	0.0493	1674	0.1705	0.0122	669	------	21.66
OP#3	1728	5	0	330	508	0	206	0.0481	1674	0.163	0.0097	670	------	22.66
3071	1929	0	0	0	0	0	214	0.052	1675	0.234	0.018	570	------	------
AIM	0	0	0	0	0	0	0	0.052	1675	0.21	0.014	570	------	------
OP#1	1569	0	0	0	0	0	230	0.0508	1670	0.2038	0.0133	699	------	32.87
OP#2	1726	0	498	0	0	0	250	0.0514	1672	0.2039	0.0139	579	------	8.62
OP#3	1454	125	0	0	0	0	223	0.0523	1670	0.2038	0.0135	605	------	14.72
3073	2079	0	0	0	0	487	212	0.051	1667	0.172	0.013	543	------	------
AIM	0	0	0	0	0	0	0	0.051	1667	0.21	0.014	543	------	------
OP#1	1882	0	0	0	0	0	140	0.0519	1664	0.1845	0.0127	549	------	18.13
OP#2	1884	8	0	0	10	0	144	0.051	1667	0.1832	0.0134	543	------	12.88
OP#3	1726	0	0	254	0	0	170	0.051	1664	0.1888	0.0125	543	------	13.11
3077	1880	0	0	0	0	1196	214	0.058	1660	0.191	0.014	689	------	------
AIM	0	0	0	0	0	0	0	0.058	1660	0.21	0.014	689	------	------
OP#1	1320	70	493	0	0	0	222	0.0549	1660	0.2098	0.0131	688	------	5.75
OP#2	1684	290	6	0	921	0	250	0.0537	1660	0.1925	0.0111	689	------	15.77
OP#3	1271	0	0	0	858	0	250	0.058	1660	0.2082	0.0114	613	------	11.99
3085	1553	0	0	0	0	539	220	0.043	1669	0.166	0.012	560	------	------
AIM	0	0	0	0	0	0	0	0.043	1669	0.19	0.013	560	------	------
OP#1	1442	0	0	0	0	0	164	0.0483	1673	0.1834	0.013	653	------	37.09
OP#2	1501	0	1496	0	0	250	161	0.0495	1669	0.1738	0.013	560	------	23.93
OP#3	1200	249	63	59	0	0	150	0.043	1669	0.1706	0.013	560	------	11.11
3090	2503	0	0	0	0	0	220	0.044	1673	0.143	0.011	818	------	------
AIM	0	0	0	0	0	0	0	0.044	1673	0.31	0.013	818	------	------
OP#1	2576	316	16	0	0	0	161	0.0456	1673	0.1482	0.0098	818	------	55.31
OP#2	2544	19	55	0	17	0	195	0.0442	1673	0.133	0.0091	818	------	57.61
OP#3	2486	23	0	0	1840	0	228	0.044	1673	0.1376	0.0084	818	------	55.76
3093	2114	0	0	0	0	0	217	0.047	1669	0.159	0.01	729	------	------
AIM	0	0	0	0	0	0	0	0.047	1669	0.31	0.013	729	------	------
OP#1	2114	182	20	0	0	0	164	0.0479	1669	0.1525	0.0099	729	------	52.77
OP#2	2117	73	14	0	0	0	153	0.047	1669	0.1426	0.0103	729	------	54.07
OP#3	1919	62	0	0	897	0	223	0.0472	1669	0.1488	0.009	730	------	52.63
3100	2010	0	0	889	526	0	217	0.049	1678	0.145	0.009	662	------	------
AIM	0	0	0	0	0	0	0	0.049	1678	0.31	0.013	662	------	------
OP#1	1836	129	563	0	0	0	175	0.049	1678	0.1782	0.0116	661	------	42.64
OP#2	1882	123	22	0	147	0	221	0.049	1678	0.169	0.0098	662	------	45.53
OP#3	1569	8	2	42	0	0	202	0.049	1677	0.1714	0.0106	668	------	46.82
3103	1898	0	0	889	568	0	222	0.05	1672	0.128	0.009	823	------	------
AIM	0	0	0	0	0	0	0	0.05	1672	0.31	0.013	823	------	------
OP#1	1391	373	170	0	0	0	223	0.053	1672	0.1847	0.0108	825	------	46.67
OP#2	1816	0	0	0	2248	0	250	0.0495	1672	0.1601	0.0081	823	------	49.51
OP#3	1410	0	0	0	2380	0	250	0.0511	1672	0.1617	0.0085	784	------	54.87
3108	3330	0	0	906	0	0	225	0.04	1713	0.109	0.008	777	------	------
AIM	0	0	0	0	0	0	0	0.04	1713	1.31	0.012	777	------	------
OP#1	3089	0	63	0	0	0	181	0.039	1712	0.1298	0.0091	777	------	93.39
OP#2	3133	0	256	0	0	0	250	0.0359	1705	0.1202	0.0081	939	-T----	160.79
OP#3	2820	0	0	21	0	0	230	0.0382	1708	0.1236	0.0091	920	------	118.12
3112	3027	0	0	0	0	0	225	0.045	1691	0.135	0.01	1178	------	------

AIM	0	0	0	0	0	0	0	0.045	1691	0.2	0.016	1178	------	------
OP#1	2693	0	1863	0	0	0	250	0.0429	1686	0.1576	0.0141	1178	------	30.69
OP#2	3155	61	0	0	623	16	250	0.0353	1686	0.131	0.0098	1015	C------	139.02
OP#3	2977	0	0	0	1535	0	250	0.0377	1691	0.1242	0.0086	988	C----O-	113.24
3114	2934	0	0	0	0	515	226	0.045	1679	0.15	0.011	894	------	------
AIM	0	0	0	0	0	0	0	0.045	1679	0.2	0.016	894	------	------
OP#1	2779	219	8	0	0	0	225	0.046	1679	0.172	0.0123	894	------	16.17
OP#2	3053	12	0	0	540	0	250	0.0407	1679	0.1511	0.0113	864	------	37.43
OP#3	2869	0	0	3	1786	0	250	0.045	1679	0.155	0.01	877	------	24.4
3122	1935	0	0	0	0	545	221	0.055	1667	0.178	0.013	651	------	------
AIM	0	0	0	0	0	0	0	0.055	1667	0.2	0.016	651	------	------
OP#1	1818	172	1083	0	0	0	161	0.0505	1667	0.2002	0.0151	649	------	8.6
OP#2	1914	187	0	0	621	16	250	0.0515	1667	0.1978	0.0132	651	------	7.52
OP#3	1591	70	123	445	0	0	243	0.0549	1667	0.2001	0.0122	650	------	0.67
3124	2327	0	0	0	0	0	223	0.043	1690	0.163	0.013	807	------	------
AIM	0	0	0	0	0	0	0	0.043	1690	0.2	0.016	807	------	------
OP#1	2444	105	280	0	0	0	192	0.043	1690	0.1622	0.013	806	------	19.14
OP#2	2583	0	0	0	306	0	250	0.0417	1690	0.1653	0.0129	797	------	21.74
OP#3	2327	23	0	0	540	0	220	0.043	1690	0.1611	0.0118	808	------	19.74
3126	2241	0	0	0	0	1218	224	0.059	1656	0.16	0.015	735	------	------
AIM	0	0	0	0	0	0	0	0.059	1656	0.23	0.013	735	------	------
OP#1	1826	446	0	0	0	0	200	0.0531	1651	0.213	0.0141	738	C---P--	119.62
OP#2	2038	0	0	0	1562	0	250	0.0521	1652	0.1926	0.0125	683	------	38.91
OP#3	1569	0	0	0	310	0	250	0.0594	1656	0.2189	0.0128	659	------	15.85
3128	2001	0	0	0	0	752	221	0.044	1691	0.154	0.011	753	------	------
AIM	0	0	0	0	0	0	0	0.044	1691	0.23	0.013	753	------	------
OP#1	2351	436	475	0	0	0	147	0.0437	1691	0.169	0.0129	753	------	27.28
OP#2	2351	97	6	0	284	0	237	0.044	1691	0.1702	0.0123	753	------	26.11
OP#3	2031	79	4	12	464	0	219	0.0449	1691	0.1665	0.0119	752	------	29.88
3130	1690	0	0	0	0	1402	226	0.05	1683	0.142	0.01	825	------	------
AIM	0	0	0	0	0	0	0	0.05	1683	0.23	0.013	825	------	------
OP#1	1469	2	248	0	0	0	236	0.0492	1679	0.1811	0.0123	824	------	26.91
OP#2	1958	0	0	0	1361	0	250	0.0454	1683	0.164	0.0107	820	------	38.55
OP#3	1423	0	0	1	633	0	250	0.0497	1683	0.1715	0.0108	806	------	28.36
3136	1924	0	0	0	0	496	226	0.057	1645	0.139	0.009	497	------	------
AIM	0	0	0	0	0	0	0	0.057	1645	0.23	0.013	497	------	------
OP#1	1750	0	0	0	0	0	174	0.0515	1640	0.162	0.0089	501	------	49.1
OP#2	1726	0	958	0	0	0	250	0.0542	1641	0.1533	0.0075	497	------	42.64
OP#3	1550	1	0	21	0	0	195	0.0524	1640	0.1637	0.0084	600	------	62.8
3141	2629	0	0	0	0	0	216	0.036	1678	0.14	0.011	1155	------	------
AIM	0	0	0	0	0	0	0	0.036	1678	0.46	0.021	1155	------	------
OP#1	2781	484	1763	0	0	0	183	0.0386	1678	0.1397	0.0133	1154	------	76.95
OP#2	3009	70	0	0	885	0	250	0.0351	1678	0.1324	0.0106	1041	------	83.59
OP#3	2979	1	10	316	2498	0	250	0.036	1678	0.1099	0.0071	995	------	90.28
3142	2196	0	0	0	0	0	211	0.037	1690	0.178	0.019	1114	------	------
AIM	0	0	0	0	0	0	0	0.037	1690	0.39	0.076	1114	------	------
OP#1	2498	499	1795	0	0	0	182	0.041	1690	0.1645	0.0156	1114	------	68.65
OP#2	2979	125	0	0	1740	0	250	0.0345	1690	0.1526	0.0126	1103	------	68.8
OP#3	2740	62	0	279	2500	0	250	0.037	1694	0.1341	0.0099	956	------	83.63
3148	2271	0	0	0	0	0	211	0.048	1689	0.156	0.014	953	------	------
AIM	0	0	0	0	0	0	0	0.048	1689	0.39	0.076	953	------	------
OP#1	2207	0	14	0	0	0	249	0.0438	1684	0.1579	0.0123	953	------	73.23

OP#2	2495	1	0	0	0	0	250	0.0411	1688	0.1599	0.0127	796	------	90.51
OP#3	2153	0	4	0	2	0	250	0.0451	1689	0.1621	0.0113	876	------	72.97
3152	2249	0	0	0	0	0	210	0.046	1674	0.175	0.017	748	------	------
AIM	0	0	0	0	0	0	0	0.046	1674	0.61	0.019	748	------	------
OP#1	2410	417	500	0	0	0	158	0.046	1674	0.1883	0.0144	749	------	69.46
OP#2	2464	125	4	0	467	59	250	0.0459	1674	0.1793	0.0133	748	------	70.85
OP#3	2268	187	4	171	1249	0	243	0.0461	1674	0.1688	0.011	748	------	72.77
3156	1844	0	0	371	0	14	205	0.053	1674	0.209	0.021	582	------	------
AIM	0	0	0	0	0	0	0	0.053	1674	0.2	0.016	582	------	------
OP#1	1916	240	628	0	0	0	143	0.0488	1674	0.2059	0.0153	583	------	11.03
OP#2	1882	9	471	0	362	102	250	0.0517	1674	0.2	0.0141	582	------	2.44
OP#3	1545	30	872	29	0	0	197	0.0529	1672	0.2004	0.0137	585	------	2.81
3158	1549	0	0	325	0	526	204	0.057	1667	0.21	0.015	688	------	------
AIM	0	0	0	0	0	0	0	0.057	1667	0.2	0.016	688	------	------
OP#1	1486	500	0	0	0	0	176	0.0517	1673	0.2273	0.0163	687	----P--	49.25
OP#2	1721	78	23	0	1153	1423	250	0.052	1667	0.2003	0.0139	688	------	8.97
OP#3	1371	1	1875	282	2463	0	250	0.0563	1667	0.2002	0.0123	688	------	1.33
3160	1850	0	0	0	0	523	206	0.058	1677	0.225	0.02	648	------	------
AIM	0	0	0	0	0	0	0	0.058	1677	0.2	0.016	648	------	------
OP#1	1630	423	117	0	0	0	176	0.0528	1677	0.2207	0.016	650	------	19.59
OP#2	1880	65	0	0	936	942	250	0.0519	1676	0.2	0.0137	643	------	12.42
OP#3	1410	84	2000	235	1004	0	250	0.0567	1677	0.2004	0.0127	649	------	2.56
3173	1933	0	0	0	0	743	206	0.047	1680	0.188	0.018	852	------	------
AIM	0	0	0	0	0	0	0	0.047	1680	0.2	0.016	852	------	------
OP#1	2038	24	240	0	0	0	229	0.0467	1680	0.1849	0.0155	850	------	8.37
OP#2	2505	0	0	0	1388	0	250	0.042	1680	0.1782	0.0145	837	------	23.45
OP#3	2141	0	0	0	1874	0	250	0.0474	1680	0.1803	0.0124	841	------	12.21
3178	1674	0	0	0	0	420	215	0.042	1668	0.154	0.012	891	------	------
AIM	0	0	0	0	0	0	0	0.042	1668	0.2	0.016	891	------	------
OP#1	1909	218	1904	0	0	0	157	0.0426	1668	0.1507	0.0129	891	------	26.22
OP#2	2124	303	131	0	645	0	239	0.042	1668	0.1393	0.0097	891	------	30.38
OP#3	1882	26	0	0	2226	0	244	0.0422	1668	0.1263	0.0074	891	------	37.3
3182	1388	0	0	0	0	92	214	0.043	1665	0.159	0.013	768	------	------
AIM	0	0	0	0	0	0	0	0.043	1665	0.2	0.016	768	------	------
OP#1	1709	289	1730	0	0	0	141	0.046	1665	0.1542	0.0126	769	------	29.95
OP#2	1943	425	80	0	374	0	182	0.0431	1665	0.1412	0.0092	768	------	29.59
OP#3	1728	6	0	0	2295	0	204	0.0431	1665	0.1316	0.0079	768	------	34.44
3184	1811	0	0	0	0	0	230	0.048	1668	0.148	0.013	855	------	------
AIM	0	0	0	0	0	0	0	0.048	1668	0.2	0.016	855	------	------
OP#1	1882	0	0	0	0	0	244	0.0425	1663	0.145	0.0106	957	------	60.57
OP#2	2192	63	0	0	303	0	250	0.0414	1668	0.1339	0.0107	850	------	47.61
OP#3	1726	0	0	0	0	0	250	0.0464	1665	0.1424	0.0088	856	------	35.1
3200	2068	0	0	0	0	0	207	0.042	1672	0.172	0.015	894	------	------
AIM	0	0	0	0	0	0	0	0.042	1672	0.2	0.016	894	------	------
OP#1	2212	359	22	0	0	0	211	0.0457	1672	0.1643	0.0133	895	------	26.82
OP#2	2586	125	0	0	1249	12	250	0.0417	1672	0.1578	0.0125	854	------	26.35
OP#3	2297	0	0	0	2500	0	250	0.0461	1672	0.1581	0.0102	860	------	34.73
3202	2367	0	0	783	0	0	208	0.051	1667	0.177	0.016	624	------	------
AIM	0	0	0	0	0	0	0	0.051	1667	0.2	0.016	624	------	------
OP#1	2134	363	246	0	0	0	160	0.0505	1667	0.2158	0.0159	622	------	9.17
OP#2	2212	1	250	0	804	152	250	0.0509	1667	0.2001	0.0148	624	------	0.41
OP#3	1928	246	0	1	1171	0	232	0.0512	1667	0.2	0.0131	623	------	0.59

3209	1681	495	0	0	0	1107	206	0.046	1669	0.149	0.013	749	------	------
AIM	0	0	0	0	0	0	0	0.046	1669	0.21	0.016	749	------	------
OP#1	1594	500	1744	0	0	0	142	0.0513	1670	0.1839	0.0142	749	-------	25.16
OP#2	1960	468	467	0	968	0	191	0.046	1669	0.162	0.0095	749	-------	22.92
OP#3	1435	6	0	4	2500	0	245	0.0522	1669	0.177	0.0097	750	-------	29.43
3210	2247	0	0	0	0	304	207	0.047	1670	0.166	0.012	735	------	------
AIM	0	0	0	0	0	0	0	0.047	1670	0.21	0.016	735	------	------
OP#1	2366	484	903	0	0	0	147	0.0479	1670	0.1665	0.0129	736	-------	22.8
OP#2	2449	80	14	0	919	0	250	0.0469	1670	0.1629	0.0107	735	-------	22.71
OP#3	2175	99	0	1	1562	0	234	0.0484	1670	0.1646	0.01	736	-------	24.67
3226	1271	0	0	0	0	502	196	0.051	1672	0.224	0.014	760	------	------
AIM	0	0	0	0	0	0	0	0.051	1672	0.41	0.016	760	------	------
OP#1	1193	181	1183	0	0	0	188	0.051	1672	0.2087	0.0151	762	-------	49.45
OP#2	1501	493	0	0	594	258	250	0.0509	1672	0.1939	0.0121	760	-------	52.91
OP#3	1244	3	6	372	1730	0	249	0.051	1672	0.1824	0.0105	760	-------	55.61
3232	1246	499	0	0	2079	449	203	0.039	1689	0.163	0.014	731	------	------
AIM	0	0	0	0	0	0	0	0.039	1689	0.91	0.012	731	------	------
OP#1	1750	500	0	0	0	0	141	0.0431	1704	0.1787	0.0136	712	----P--	243.56
OP#2	2038	90	1984	0	743	1060	169	0.039	1689	0.145	0.011	731	-------	84.1
OP#3	1804	313	0	1312	2366	0	240	0.0388	1689	0.1262	0.0084	730	-------	86.76
3234	1561	496	0	0	0	1116	205	0.043	1691	0.169	0.013	637	------	------
AIM	0	0	0	0	0	0	0	0.043	1691	0.91	0.012	637	------	------
OP#1	1985	315	0	0	0	0	140	0.0429	1706	0.1819	0.014	644	----P--	261.16
OP#2	2048	7	1978	0	29	1138	212	0.043	1691	0.1577	0.0119	637	-------	82.76
OP#3	1726	83	1005	524	1251	0	181	0.043	1691	0.1565	0.012	637	-------	83.17
3236	1799	498	0	0	0	1534	206	0.044	1686	0.154	0.011	666	------	------
AIM	0	0	0	0	0	0	0	0.044	1686	0.91	0.012	666	------	------
OP#1	1972	500	0	0	0	0	142	0.046	1701	0.1743	0.0127	659	----P--	155.9
OP#2	2043	108	880	0	303	1314	181	0.044	1686	0.1522	0.0099	666	-------	83.32
OP#3	1990	110	2	1386	1500	0	216	0.044	1686	0.1431	0.0092	665	-------	84.57
3242	2226	0	0	0	0	0	203	0.046	1704	0.21	0.021	799	------	------
AIM	0	0	0	0	0	0	0	0.046	1704	0.41	0.016	799	------	------
OP#1	2537	444	250	0	0	0	182	0.0474	1704	0.198	0.0158	801	-------	55.02
OP#2	2813	193	0	0	616	0	250	0.0427	1704	0.186	0.0144	798	-------	61.87
OP#3	2679	8	0	526	1650	0	240	0.046	1704	0.1762	0.013	799	-------	57.13
3247	2664	0	0	0	0	0	204	0.045	1683	0.139	0.009	897	------	------
AIM	0	0	0	0	0	0	0	0.045	1683	0.41	0.016	897	------	------
OP#1	2434	23	117	0	0	0	236	0.045	1683	0.1765	0.0129	898	-------	57.13
OP#2	2828	250	0	0	244	0	250	0.0396	1683	0.1543	0.0119	897	-------	74.4
OP#3	2486	3	4	7	1249	0	250	0.045	1683	0.16	0.011	875	-------	63.6
3251	2335	0	0	0	4	220	205	0.055	1674	0.157	0.013	506	------	------
AIM	0	0	0	0	0	0	0	0.055	1674	0.41	0.016	506	------	------
OP#1	2258	0	143	0	0	0	167	0.0506	1673	0.1834	0.013	505	-------	64.55
OP#2	2195	0	497	0	0	0	250	0.052	1670	0.1844	0.012	517	-------	67.02
OP#3	2117	0	0	12	0	0	147	0.0486	1669	0.1867	0.0132	516	-------	72.9
3264	1736	0	0	0	0	379	212	0.043	1677	0.199	0.019	880	------	------
AIM	0	0	0	0	0	0	0	0.043	1677	0.46	0.021	880	------	------
OP#1	2016	481	1896	0	0	0	142	0.0451	1677	0.1818	0.0157	878	-------	65.54
OP#2	2293	462	174	0	740	31	245	0.043	1677	0.1739	0.0127	880	-------	62.24
OP#3	2339	3	0	876	2500	0	250	0.043	1678	0.1432	0.0092	856	-------	72.78
3269	1937	0	0	572	0	0	205	0.046	1660	0.111	0.012	1120	------	------
AIM	0	0	0	0	0	0	0	0.046	1660	0.46	0.021	1120	------	------

OP#1	1738	2	1466	0	0	0	250	0.0437	1660	0.1225	0.0112	1120	------	78.66
OP#2	2273	8	0	0	1769	0	250	0.0391	1660	0.1103	0.0075	974	------	104.01
OP#3	2029	0	0	21	2500	0	250	0.0396	1662	0.097	0.0049	958	------	108.95
3276	2275	0	0	0	0	0	207	0.042	1691	0.116	0.01	1129	------	------
AIM	0	0	0	0	0	0	0	0.042	1691	0.41	0.016	1129	------	------
OP#1	2383	0	1112	0	0	0	250	0.0412	1690	0.1358	0.0119	1129	------	70.24
OP#2	2818	0	0	0	655	0	250	0.0356	1691	0.1087	0.0087	977	------	102.26
OP#3	2508	0	0	5	1339	0	250	0.0385	1691	0.1047	0.0073	976	------	96.4
3278	2106	0	0	0	0	0	210	0.038	1673	0.134	0.011	1007	------	------
AIM	0	0	0	0	0	0	0	0.038	1673	0.41	0.016	1007	------	------
OP#1	2385	493	1161	0	0	0	180	0.0423	1673	0.1516	0.0129	1008	------	74.6
OP#2	2745	271	0	0	1171	0	250	0.0379	1673	0.1203	0.009	1005	------	71.15
OP#3	2747	49	6	786	2500	0	250	0.038	1673	0.0928	0.0055	917	------	86.91
3282	1982	0	0	0	0	464	212	0.054	1672	0.178	0.015	658	------	------
AIM	0	0	0	0	0	0	0	0.054	1672	0.41	0.016	658	------	------
OP#1	1938	0	196	0	0	0	194	0.0487	1670	0.1968	0.0139	656	------	63.72
OP#2	2068	106	14	0	169	27	250	0.0491	1672	0.1897	0.0135	658	------	62.79
OP#3	1726	0	0	19	0	0	212	0.052	1669	0.1988	0.0133	658	------	57.97
3289	2443	0	0	0	0	98	210	0.047	1647	0.167	0.014	685	------	------
AIM	0	0	0	0	0	0	0	0.047	1647	0.21	0.014	685	------	------
OP#1	2351	500	530	0	0	0	140	0.0473	1648	0.161	0.0121	685	------	24.47
OP#2	2381	58	45	0	921	0	226	0.047	1647	0.1581	0.0111	685	------	24.87
OP#3	2100	278	0	3	1562	0	242	0.0481	1647	0.1566	0.0087	686	------	27.92
3291	2155	0	0	0	0	99	214	0.051	1659	0.164	0.014	743	------	------
AIM	0	0	0	0	0	0	0	0.051	1659	0.21	0.014	743	------	------
OP#1	2048	352	344	0	0	0	192	0.0514	1659	0.1983	0.0139	741	------	6.74
OP#2	2312	35	23	0	1486	0	250	0.0489	1659	0.176	0.012	743	------	20.26
OP#3	2029	0	0	0	2153	0	250	0.0538	1659	0.1871	0.011	743	------	16.5
3295	2030	0	0	0	0	597	214	0.051	1656	0.14	0.01	788	------	------
AIM	0	0	0	0	0	0	0	0.051	1656	0.21	0.014	788	------	------
OP#1	1809	0	18	0	0	0	242	0.051	1654	0.1682	0.0099	788	------	22.33
OP#2	2173	0	0	0	1080	0	250	0.0474	1656	0.1429	0.0078	788	------	39.12
OP#3	1794	0	0	0	780	0	250	0.0511	1656	0.1559	0.0078	784	------	26.56
3297	2279	0	0	0	0	1553	218	0.042	1651	0.141	0.01	768	------	------
AIM	0	0	0	0	0	0	0	0.042	1651	0.21	0.014	768	------	------
OP#1	2351	498	1277	0	0	0	140	0.0472	1662	0.1823	0.0139	768	------	36.52
OP#2	2434	437	47	0	623	27	140	0.0424	1651	0.1558	0.0105	768	------	26.72
OP#3	2351	18	0	23	2500	0	222	0.0461	1661	0.1564	0.0093	769	------	45.8
3299	2013	0	0	0	0	886	214	0.046	1645	0.142	0.012	890	------	------
AIM	0	0	0	0	0	0	0	0.046	1645	0.21	0.014	890	------	------
OP#1	1992	449	1183	0	0	0	194	0.0508	1645	0.178	0.0127	889	------	25.69
OP#2	2429	62	201	0	2187	4	250	0.0458	1645	0.1408	0.0085	890	------	33.44
OP#3	2009	0	0	0	2500	0	250	0.0521	1645	0.1599	0.008	769	------	50.84
3301	2171	0	0	198	0	0	214	0.046	1673	0.169	0.011	843	------	------
AIM	0	0	0	0	0	0	0	0.046	1673	0.14	0.013	843	------	------
OP#1	2390	500	452	0	0	0	162	0.0433	1674	0.1698	0.013	841	------	28.6
OP#2	2544	0	123	0	0	1674	250	0.042	1671	0.14	0.0104	843	------	10.33
OP#3	2290	9	1969	304	1562	0	250	0.0459	1673	0.14	0.0087	842	------	0.31
3306	2238	0	0	501	0	0	214	0.044	1662	0.139	0.01	874	------	------
AIM	0	0	0	0	0	0	0	0.044	1662	0.21	0.016	874	------	------
OP#1	2381	385	18	0	0	0	195	0.044	1662	0.1472	0.01	873	------	30.14
OP#2	2544	0	0	0	1007	0	250	0.0424	1662	0.1413	0.0096	870	------	36.8

OP#3	2356	0	0	22	1874	0	247	0.0445	1662	0.1381	0.0078	875	-------	35.58
3309	1710	0	0	806	0	0	200	0.044	1646	0.148	0.009	825	------	------
AIM	0	0	0	0	0	0	0	0.044	1646	0.13	0.014	825	------	------
OP#1	2056	500	753	0	0	0	146	0.0424	1655	0.16	0.0116	827	-------	36.33
OP#2	2195	56	1875	0	941	661	249	0.043	1646	0.13	0.0086	826	-------	2.44
OP#3	1994	92	96	552	2500	0	250	0.044	1647	0.13	0.0063	821	-------	1.65
3311	1469	0	0	0	0	0	211	0.046	1669	0.174	0.015	826	------	------
AIM	0	0	0	0	0	0	0	0.046	1669	0.21	0.016	826	------	------
OP#1	1381	18	47	0	0	0	226	0.0462	1669	0.1893	0.0134	825	-------	10.41
OP#2	1738	188	0	0	1134	0	250	0.0459	1669	0.1796	0.0132	825	-------	14.75
OP#3	1449	16	0	0	1865	0	242	0.0464	1669	0.1656	0.0107	825	-------	22.19
3317	1741	0	0	537	0	0	209	0.047	1652	0.164	0.01	753	------	------
AIM	0	0	0	0	0	0	0	0.047	1652	0.41	0.016	753	------	------
OP#1	1916	154	1361	0	0	0	165	0.0471	1652	0.1631	0.0123	755	-------	60.73
OP#2	2051	124	61	0	797	4	234	0.047	1652	0.1539	0.0098	753	-------	62.54
OP#3	1840	103	0	129	1249	0	236	0.047	1653	0.1471	0.0079	753	-------	64.82
3321	1830	0	0	0	1344	2073	200	0.041	1633	0.138	0.008	968	------	------
AIM	0	0	0	0	0	0	0	0.041	1633	0.13	0.014	968	------	------
OP#1	2026	500	1969	0	0	0	141	0.041	1648	0.1455	0.0125	967	-------	26.74
OP#2	2195	500	1249	0	1483	4	236	0.041	1633	0.13	0.0081	968	-------	0.47
OP#3	1806	121	0	0	2500	0	250	0.0429	1643	0.13	0.0062	857	-------	26.4
3323	1653	0	0	0	0	1215	200	0.041	1645	0.135	0.008	915	------	------
AIM	0	0	0	0	0	0	0	0.041	1645	0.13	0.014	915	------	------
OP#1	1804	467	1548	0	0	0	140	0.0405	1645	0.1342	0.0108	915	------	4.74
OP#2	1948	174	282	0	1107	74	214	0.041	1645	0.13	0.0088	915	------	0.13
OP#3	1726	0	0	0	2500	0	247	0.042	1646	0.1186	0.0056	915	------	12.5
3327	1938	0	0	943	682	0	203	0.051	1661	0.163	0.009	714	------	------
AIM	0	0	0	0	0	0	0	0.051	1661	0.23	0.013	714	------	------
OP#1	1848	383	0	0	0	0	195	0.0521	1661	0.1986	0.0122	713	-------	16.04
OP#2	2019	76	0	0	1171	0	243	0.051	1661	0.1757	0.0104	714	-------	23.71
OP#3	1726	125	0	33	1562	0	250	0.052	1661	0.176	0.0095	715	-------	25.79